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PLATE I

Diabetic Retinitis (Burch). Journal-Lancet, April 1, 1928, "Ocular Conditions Associated with Diabetes."

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The Eye, Ear, Nose and Throat

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THE EYE

Introduction

The Relation of the Ophthalmologist to the General Medical Profession. It is wise for one who is engaged in active work of any kind to pause now and again to review his own work and his relationship to his fellow workers. The contacts of medical men are so varied, yet, at the same time, so intimate that such a course seems particularly necessary for them. A review of this sort is sometimes aided by a glance at history and a study of the present with the help of a knowledge of the past. Thus the orientation is frequently made more certain and the weighing of our needs is better done.

A glance at the history of ophthalmology reveals that the study of this subject goes back as far as the history of medicine reaches and some mention of work upon eyes is made in the "Code of Hammurabi" (about 2250 B. C.). This was a legal, not a medical, work but it mentions operations upon the lids and the treatment of the eye. From this time on we find all through the physician-priests' time and down to the very modern days that ophthalmology was advancing with about equal rapidity with the art of medicine and that none of those men who were observing the diseases of the eye and treating them were ophthalmologists in the sense that they were devoting their time and effort to this branch of medicine alone, but were better known as physicians and workers in the healing art, their work in diseases of the eye being an incident to their practice.

Hippocrates, Celsus and Galen among many others of the ancients have left us accounts of the diseases of the eye and their treatments. The work of Galen on the anatomy and physiology of the eye was the outstanding

authority for sixteen hundred years following its writing. His study of optics was the best of its time, though it did not endure as authority for so long a time. These men were workers and teachers of the art of healing and their work in ophthalmology was only a part of their notable contributions to the medical knowledge of their time.

The eye offered to the worker in medicine in the early days a temptation to investigate, in that many of its ailments presented marked objective symptoms and the effect of remedies upon these symptoms could be readily studied.

There was gradual advance in the study of eye conditions during the Middle Ages when such study little by little freed the treatment from priestly incantation and superstition and repetition of magic words when remedies were applied, but this advance was taking place in like measure throughout the entire domain of medicine. Thus did ophthalmology advance by slow steps until the middle of the Nineteenth Century when an enormous leap was made by the discovery of the ophthalmoscope by Helmholtz, and with the birth of this instrument the science of ophthalmology had come. Helmholtz was a physician and physiologist. As a result of this epoch-making instrument ophthalmology was advanced enormously and at the same time, as Clifton Miller[1] shows, was somewhat retarded. The retardation came as a result of the growing up of a class called eye specialists who by education were physicians, but who elected to devote their entire attention to diseases of the eye and its adnexa. Many of this class thought that a perfect knowledge of these diseases could be acquired in six weeks to three months and during this short period they made strenuous effort to forget a large part of the physiology and pathology that they had acquired with much labor during the time they spent over their medical education. The eye was treated by many of these as

(1) South. M. J., January, 1928.

an organ entirely independent of the rest of the human economy and as though all the general physiological and pathological truths had no bearing here. When a connection was found by them it was as the diseases with which they dealt caused suffering or trouble elsewhere in the system, not as to what remote trouble could produce symptoms in the eye. The entire system was viewed through the pupil and wise comment made thereon as though one could appreciate and criticize the beauties of an art gallery through the key-hole of its door of entrance.

Teachers and workers in ophthalmology are, by their precept and example, causing this class to pass away, but the passage is too slow. There are too many who still cling to these ideas and allow other branches of the medical profession to view them as laboratory technicians to whom a patient is sent for the purpose of getting certain data and, after these facts are furnished, no further use for their knowledge is felt. This is not as it should be. Who can furnish better aids in diagnosis in many lines than the ophthalmologist who has a broad view of medical science? To him probably more often than to any other member of the medical profession are presented the patients with persistent or periodical headaches and though the cause of these may not be an error of refraction he should be able, as a result of his studies, to offer valuable advice as to the etiology of this symptom.

Some of the symptoms of focal infection appear in the eye with as great frequency as in any other area of the body, and, working backward from this, the opthalmologist's aid in locating the focus should be invaluable and he should know how to look.

In studying diseases of the eye we are confronted by the fact that, with the exception of traumata and superficial infections, there is scarcely a pathological condition found in this organ that is not due to disease in some organ more or less remote. Recognizing this fact,

how important it is that we be perpared to work intelligently with the pathologist and internist in finding, and, if possible, correcting this distant trouble.

The effects of the injection of foreign protein for the purpose of combating local infection can be studied in the eye to as great or greater advantage than in any other portion of the body. Therefore, the opthalmologist working with the pathologist should be able to determine what character of protein is of greatest service and what route of introduction is best. In the present trend of medicine this offers a tempting line for research.

The closer the touch maintained by the ophthalmologist with all other branches of medicine the greater service will he be able to render to his profession and to humanity, and that, after all, is one of the main goals of the physician.

Hereditary Abnormalities of the Eye

Developmental Defects of the External Structures of the Eye and Orbit. Congenital anomalies of the eye and orbit are varied and numerous. The more highly specialized the structure, the more likely are developmental defects to occur. N. S. Weinberger[2] deals with congenital variations of the orbit, muscles, scleral coat, and lacrimal apparatus. Albinism, color blindness, word blindness, etc., are included.

The Sclera. The sclera proper does not offer much in the way of congenital variation. An interesting condition is congenital thinning out, bluish discoloration of the sclera, with brittleness of the bones, and deafness. Total ectasia—hydrophthalmos and buphthalmos, with or without participation of the cornea—is either congenital or acquired in early childhood. It is probably the analogue of glaucoma in adults.

(2) Atlantic M. J., March, 1928.

Hydrophthalmos may be an associated condition in Recklinghausen's disease. The different phenomena of neurofibromatosis multiplex are mostly congenital. All of the changes are seldom present in any one case. According to Fuchs, they are multiple neurofibromata, fibrous mollusca, and flat pigment moles of the skin, plexiform neuroma, lymphangioma of the lids and orbit, unilateral hypertrophy of the face, and tumors of the optic and auditory nerves.

Volmer reports an epibulbar dermoid cyst containing a tooth and firmly adherent to the sclera. The cyst was located between the lateral and superior recti below the conjunctiva, which was normal, and radial to the limbus. It was firmly adherent to the sclera, and, after the anterior capsule had been removed, was found to contain a tooth. Whether or not the cyst in this case was found at its primary site of development could not be determined. At any rate there was no connecting band leading to the bulbus.

The Cornea. Dermoid cyst of the cornea shows the same characteristics as other dermoid cysts. It rides the margin of the cornea like a misplaced island of skin, involves the conjunctiva, is white or reddish-white in color, flat and sessile, is usually situated on the temporal side, and is immovable. Other congenital anomalies are apt to be present elsewhere. The cyst may grow in size after birth. In the newborn, a dense bluish-white opacity of the cornea is sometimes seen. This opacity is often produced by traumatism (usually forceps), and will very likely disappear in time. It may be inflammatory — fetal keratitis. Embryotoxon is a congenital opacity resembling gerontoxon. Melanosis corneæ is a congenital opacity of the deep central layers. It is symmetrical and, as a rule, involves both eyes. This symmetry, uniformity, and location serve to differentiate it from acquired pigmentations of the posterior layers, as

in iridocyclitis, blood staining, or pigmentation from anilin dyes.

Kreidlova describes an anatomic finding of a congenital corneal opacity without any trace of inflammatory changes. The opacity was caused by marked thickening of Bowman's membrane and a defect in the endothelium. He also found the epithelium thinned, the stroma loosened, and a slightly diffuse anterior synechia thinned almost to half its size. Descemet's membrane and endothelium were partially wanting. The extensive embryotoxons and ectopia of the pupil also indicated a fundamental disturbance of embryonic development.

A second clinical observation is also of value in the same sense in which microphthalmos, embryotoxon, central leukoma adhærens, congenital iris coloboma on one side and on the other, congenital anophthalmos were present.

Metamorphoses of congenital opacities are not so liable to occur as in the acquired, but the possibility of change in later life is recognized and must be borne in mind as a factor in diagnosis. Miller reports a case of congenital dermoid cyst of the cornea in conjunction with dermolipoma at the outer canthus. Flat cornea is described by Swett in his report of a case.

All of the reported cases show the same small flat cornea and the overlapping limbus with the cloudy, milky-white peripheral zone, giving the impression that the sclera is continuous with the cornea. Ruebel reports the condition in three brothers.

Von Hippel, also Ruebel, find the delicate parenchymatous cloudiness to be of the same structure as the sclera, and can find no other cause for it than a congenital anomaly. It is stationary, as none of the reported cases show a subsequent increase in the curvature.

Swett gives the following table as useful in differentiating between cornea plana and microcornea:

Cornea plana	*Microcornea*
1. Abnormal flatness.	1. Increased or normal curvature.
2. Poorly defined limbus.	2. Normal, clearly placed limbus.
3. Corneal refraction average 28 to 35 D.	3. Average 46 D.
4. Corneal radius 10 mm.	4. Corneal radius 7.3 mm.
5. Total refraction plus 7 D.	5. Minus 2 D to plus 18 D.
6. Normally formed or enlarged bulbus.	6. Microphthalmia.
7. Malformation of anterior segment and limbus.	7. Malformation of entire globe; normal-shaped limbus.

Intra-uterine, i. e., congenital, inflammatory ulcer of the cornea is rare. Both congenital opacities and staphylomata are usually the result of noninflammatory deformities. Seefelder, in a study of both eyes of a kitten, six days old, which at birth showed complete symmetric staphylomata of the cornea, found that the origin of the condition was probably inflammatory.

The important feature of this study was the demonstration of an inflammatory origin of congenital staphyloma. Neither the organism nor the mode of infection could be determined. The latter was most likely endogenous, although the rest of the litter and the animal itself, except for the eyes, were perfectly normal and healthy.

The Conjunctiva. Epitarsus (Schapringer) or "apron of the conjunctiva" is a flat fold of conjunctiva of the lid, trianguloid in shape with its base directed upward. It is attached about the convex border of the tarsus above and near the free border of the lid below. A probe can usually be passed beneath it. This anomaly is considered by most authorities to be acquired as a result of ophthalmia neonatorum, although the congenital possibility is admitted by many.

Subconjunctival lipoma is a fatty tumor situated between the external rectus and the superior rectus; it is triangular in shape — base toward the cornea — and yellowish in color. Conjunctival lipomata may be quite

large, and tend to grow at puberty. The conjunctiva over the tumor may resemble skin (lipodermoid). Ordinary cysts of the conjunctiva may be congenital. Angiomata of the conjunctiva are usually congenital and tend to grow larger. Melanosis may also occur in the conjunctiva.

The Eye Muscles. Ophthalmoplegia — internal, external, or total—may be congenital. Congenital paralyses most often involve the abducens. In these conditions, secondary contracture of the antagonists does not occur as it does in the acquired paralyses, and the paralysis is not apparent unless the patient attempts to turn the eyes in a direction in which the paralyzed muscle would be brought into play. The superior rectus may be absent, as is sometimes seen when congenital ptosis exists. It is quite frequently paretic even when no ptosis exists, and fixing with the paretic eye on adduction produces deviation upward of the unaffected eye. The inferior rectus is commonly involved, either slightly or markedly.

Duane's syndrome—paralysis of the external rectus and paresis of the internal rectus — produces a false ptosis when the eye is turned in.

The eye retracts into the orbit and turns upward while the lids partly close. Duane states the situation clearly and concisely as follows: "Many cases of so-called congenital paralysis are really due to absence, abnormal insertion, or other structural anomalies of the muscles themselves." Faulty position and deviation of the head are evident in early life because of muscle anomalies, and these anomalies may easily be factors in the development of squint, the congenital variation encouraging an added acquired deviation. These statements show the need of careful study of conditions before muscle operations are attempted.

Posey, in his paper on anomalies of the ocular muscles, etc., discusses the subject under two headings: supernumerary muscles of the eyelids and the orbit and

those of the eyeball itself. In the first he quotes liberally from Howe's work on muscles. The first part of the discussion comprises the muscle of Horner, which is not often mentioned in textbooks, and which is of considerable importance in tenotomy of the internal rectus. The second part takes up the gracilimus or transversus, described by various anatomists. It lies near the roof of the orbit, and is variously described as a band passing from the levator palpebræ superioris with inward connections to the oblique. It may be given off from the levator superioris in the shape of small branches of bundles inserted in the trochlearis. It may also arise from the anterosuperior portion of the orbital plate, pass directly across the upper part of the orbit, and consist of small tendinous bands enlarging into fleshy bundles and inserting into neighboring fascia, especially into the levator palpebræ superioris.

Anomalies of the muscles of the eyeball itself comprise absence of a muscle, such as the internus, externus, or superior rectus, both inferior recti, the oblique, and even all the muscles of the eye, as in a case described by Klincosch. It is in operation for the correction of congenital strabismus, and sometimes also of squint, that the absence of one or another muscle is noted Sometimes muscles are found merged together or united to neighboring parts.

The author describes a personal experience during a squint operation in which the external rectus was inserted by two tendons. The patient was a boy (age not given). The right eye had converged from birth, and had not been corrected by glasses worn since his sixth year. Examination showed an alternating concomitant converging squint at 45°. A double advancement operation was performed. The left externus, instead of the usual single insertion, was found to have two tendinous insertions into the globe—two bands equal in size and development and about 4 mm. apart. They merged into two well-developed muscle bellies running parallel with

one another until they were lost posteriorly in the tissues of the orbit. The insertion of the right rectus was normal.

In another instance of congenital right convergent squint, Posey found an accessory well-developed muscle just inferior to the tendon of the external rectus inserted into the globe by a short rounded tendon, passing obliquely downward between the externus and inferior rectus muscles, and disappearing in the tissues at the equator.

These and the other muscle anomalies described in the literature are explained as intra-uterine errors in development by cleavage from the embryonic mesoblastic mass. They are all accompanied by deviations in the ocular axes, which may be confusing to the clinician as well as to the operator unmindful or unacquainted with such aberrations.

The Eyelids. The obicularis muscles may be absent or practically wanting, as in a case cited by Blatt, in which there seemed to be unilateral absence of the left muscle The main points of interest in this congenital phenomenon in his case are briefly quoted: "Complete absence or arrested development of one of the muscles innervated by the facial nerve while the other muscles are intact is a very unusual phenomenon. If the faulty development and inactivity involve only one muscle of the lower facial musculature, its inactivity could easily remain unnoticed. But if the anomaly involves the orbicularis oculi, the symptoms are prominent, and call attention to the maldevelopment of the muscle on the one side."

Another rare anomaly is congenital cyst of the lower lid filled with serous liquid and lined with retinal tissue. It is associated with microphthalmos and a process connects the two.

In the phenomenon of congenital ptosis the levator palpebræ superioris is poorly developed or absent. Both eyes, as a rule, are affected, although not to the same

degree. Inheritance seems to play a distinct rôle. Deficiency or absence of the superior rectus and the epicanthus are often associated with congenital ptosis.

Angiomata of the lid are telangiectases or cavernous tumors. They are congenital, but may grow later in life. The telangiectases are dilated and tortuous blood vessels in the skin of the lid. The cavernous tumors lie beneath the skin, causing a bluish, soft, compressible mass. Coloboma of the lid is rarely congenital. It occurs more often in the upper lid, and is apt to be accompanied by other anomalies, particularly dermoid tumor of the cornea In Mongols a moderate degree of epicanthus is characteristic of the race. The higher degrees are a congenital malformation in all cases. It is apt to be associated with ptosis.

Congenital distichiasis. This anomaly was seen by Doherty, who reviewed the literature, and reported the following case:

> The patient was a boy aged seven years. The appearance of his eyes suggested those of a dog. The upper and lower lids of both were affected. The supernumerary row of cilia were on the posterior edge of the lids, symmetrically placed, with even intermarginal spaces, and were normal as to length, number, and development. They were directed upward and downward from their respective lids, very nearly interlacing when the eyes were open. They rested against the cornea, which had the appearance of being protected by a layer of tears. Microscopic examination failed to show any opacities. The only complaint was a sensation of sand in the eyes and considerable lacrimation. There were no other congenital malformations present.

Similar cases have been reported by Parsons, Kuhnt, Collins and Mayou, Szily, Begle, and Tibbles. Owing to the fact that the meibomian glands are often absent, it is assumed that hair follicles developed in their place. Blatt reported five cases in one family which showed inheritance through three generations.

Moravec cites the case of a woman, aged 27 years, in whom generalized fibromatosis of the entire body leading to elephantiasis of the left eye was present. The noteworthy points in this case were the presence of dermoids of the bulbar connective tissue, left iris coloboma,

and right retinal coloboma. Such a combination of developmental anomalies and neurofibromatosis had hitherto not been described. It seems to indicate that the latter is referable to a hereditary degenerative tendency, a theory which receives some support from the fact that the patient's grandfather had the same disease. No mention is made of either hydro-ophthalmic enlargement of the eye or of tension.

Among other anomalies of the lids not heretofore mentioned in this paper Duane lists abnormal narrowness or entire absence of the lids (ablepharia) and symblepharon—complete covering of the eye by external skin—the latter replacing the lids and forming a uniform covering for the aperture of the orbit (cryptophthalmus of Zehender).

Lacrimal Apparatus. Duplication of the puncta and canaliculi as well as their absence has been recorded. Congenital elongation of the inferior lacrimal canal has been seen in two children by van der Hoeve. His observations are briefly stated as follows:

> The two children, aged six and nine months respectively, had unusually wide nasal bridges and very narrow palpebral fissures due to adhesions of the eyelid at the nasal angle. The superior lacrimal puncta were found at the normal site, and the inferior lacrimal puncta were located much more temporalward than normal.

Chronic dacryocystitis is not infrequently observed in the newborn. Perforation and fistula have been seen. In the fetus the lower end of the nasal duct is closed by a thin diaphragm. Belated perforation results in this disease. According to Rochon-Duvigneaud, decomposition of the gelatinous contents of the passages sets in and inflammation of the tear passages ensues. Congenital lacrimal obstruction may also be present above the sac. In this case the obstruction may be partial or complete.

The Orbit. Enophthalmos may be a congenital anomaly of position. In congenital paralysis of the external rectus the eye sinks back into the orbit on ad-

duction, owing to the pull of the internus against the inelastic externus.

Cephalocele is a tumor situated at the upper inner angle of the orbit; it is covered by skin, and fluctuates. The difficulty of differentiation from dermoid cyst situated in this area cannot be regarded lightly, since removal of a cephalocele would be a serious matter, unless the communication between the meningocele and the cranial cavity is happily obliterated. The main points of differentiation are as follows:

Dermoid Cyst	*Cephalocele*
1. Movable.	1. More fixed.
2. No palpable bony aperture.	2. Aperture may occasionally be felt.
3. No pulsation.	3. Sometimes pulsates.
4. Same size under pressure.	4. Diminution under pressure with possible symptoms of increased intracranial tension.
5. X-ray shows no aperture in bone.	5. May show aperture.
6. Exploratory puncture negative for spinal fluid.	6. Cerebrospinal fluid positive.

Dermoid cyst is situated at the upper outer or upper inner angle of the orbit. The wall contains the structures of the skin The contents consist of sebum, exfoliated epithelium, hair, and sometimes teeth. Sometimes the contents become converted into an oily liquid (oil cyst), some resemble honey (meliceris), and some are serous. According to Panas, those resembling serum originate from invagination of the nasal mucous membrane instead of the external germinal layer. Remak places them all in the category of original invagination of the external germinal layer with subsequent cystic change.

Angiomata.—Telangiectases and cavernous tumors are usually congenital, but are apt to grow considerably after birth. The former originate in the lid and later extend into the orbit. They are readily diagnosed at birth because of their superficiality. Cavernous angio-

mata originate in the orbit and their early diagnosis is not easy. Although some do not regard them as congenital phenomena, it is the sense of the writer that the postnatal growth is simply an elaboration of a congenital variation. In fact, the early diagnosis of these deep-seated orbital vascular tumors depends largely upon their variability in volume. When they have become larger and gleam through the skin with a bluish luster, the diagnosis is comparatively easy.

Teratoma of the orbit is rare. The literature affords two papers with case reports of particular interest—one by Kearney and the other by Corbett. Kearney's paper reviewed the literature up to 1926 He found ten cases, all of them in foreign countries. Corbett's paper, published in 1925, is not included in Kearney's review. Kearney's grouping and the modified Marchand theory follow:

"Origin: Orbital teratomata may be grouped, representing all the stages from the mixed tumor to the diplogenetic structures, as follows: (1) The fetus is fastened by its pedicle in the orbit. (2) Parts of the body of a fetus hang from the orbit. (3) A formless mass hangs from the orbit shown histologically to be derived from all three primitive layers. (4) A tumor mass in the orbit shown microscopically to be composed of different parts, cysts, bones, etc., having the characteristics of a mixed tumor and traceable to two primitive embryonic layers."

The modified Marchand theory, as given by von Hippel, best explains the phenomenon: "In the beginning of the development of the embryo, one blastomere comes to lie on the faster growing organism and remains dormant to develop at a later time or it begins to develop at once in the early embryonic life. Such cases, where they are not far removed by cleavage from the original ovum are capable of developing complete organisms. The greater the number of divisions of the original cell before such a blastomere is segregated, the less potent it

is of development. So we have such cells developing complete organisms or only parts thereof, or giving rise to more embryonic layers accordingly as they are near the first cleavage or distant from it."

The Eyeball. Microphthalmos and apparent anophthalmos are the result of failure of the margins of the ocular vesicles to unite. This union is prevented because of obstruction by a process of mesoderm. Rotation ensues and the margins grow faultily—either into the anterior of the eye or more often toward the outside. If the latter is the case, a pocket containing retinal tissue is formed at the lower side of the eyeball. The eyeball then may remain quite small, while the sac develops to a considerable size. This is the congenital cyst of the lower lid previously mentioned, filled with serous fluid, lined with retinal tissue, and connected with rudimentary eyeball.

Derkac described a case of anophthalmos with orbitopalpebral cyst of the lower lid in a female infant, aged three weeks. The lower lids of both eyes were markedly edematous in appearance, being bulged outward by a transparent fluctuating cyst. Absence of bulbi in both eyes was noted, and the connective-tissue sac was drawn backward in a funnel-shaped manner. The connective tissue was hypertrophied. Illumination with the Sach's lamp showed the presence in the left cyst of a bean-sized structure. The content of the cyst was an albuminoid (16.31 per cent), yellowish fluid, blood-streaked in its lower part.

Gallemagerts found an instance of familial anophthalmos in a group of three children whose mother had left microphthalmia. The oldest child's eyes were normal. In the second child, the right eye was very small and microphthalmic with a porcelainlike cornea, and the left eye showed no visible signs of an eyeball. The orbit was very much depressed, and the conjunctival sac scarcely indicated. The third child, who died at the age of three months, had pronounced anophthalmia.

Two hypotheses are admissible regarding the anomaly: (1) The ocular vesicle reaches a certain stage of development and then undergoes degeneration as the result of a pathologic process. This degeneration may be present in different degrees, which may take place in various stages of development, and thus produce the types of microphthalmia or anophthalmia which have been observed. (2) The ocular vesicle fails to develop, the bud disappearing on the first day (as observed by Hess in a chicken embryo of 120 hours) without leaving any trace, resulting in the total absence of any vestige of ocular formation, as in the author's case.

The action of toxins causes deviations and proliferations of phlegmasia with atrophy and regression of the organ or part of the organ. Syphilis or tuberculosis may be the active agent. According to the author's observations in other cases of microphthalmia, syphilis plays an important rôle.

Albinism. Albinos do not have any physiologic pigment. The hair is yellowish white and the eyelashes and eyebrows are white. The pupil is bright red and the iris gray, except by transmitted light, when it is red. The fundus is almost white, and the retinal and choroidal vessels can be distinctly seen upon it. The papilla is dark and grayish red. The pigmentiferous cells of the uvea and retina are present, but contain no pigment. Photophobia is bothersome, and vision is better at dusk; myopia and strabismus are common; nystagmus is usually associated; and vision is subnormal. There are all kinds of transitional forms of deficiency of pigmentation ranging from true albinisms to normal. There are semi-albinos with large nonpigmented areas alternating wih islands of normal pigmentation in the fundus, especially so in infants and children. The albinotic areas are more likely to be located in the periphery of the fundus. There is an inheritance and consanguinity factor in albinism, and there may be multiple symptoms.

Other Anomalies. Cyclopia is a rare congenital con-

dition. Two very good descriptions of it are found in papers by Humphrey and Casaldi. Humphrey's paper is a detailed anatomical report, while Castaldi's is more general, and reviews the theories involved. The latter paper is most interesting, and discusses the genesis of cyclopia.

Congenital word blindness properly belongs in the field of neurology and psychiatry, and no further reference to it will be made, except to mention the work and writings of Orton, McCready, and Minogue.

Color blindness may be congenital or acquired. The cause of the congenital condition (Daltonism) is not understood. It is not dependent upon disease. It may be total or partial, the latter being frequent. The commonest affection is weakness of color sense without complete blindness for any one color. There are many transition forms between normal color sense and complete color blindness. The Young-Helmholtz theory of color perception probably best explains congenital color blindness. Sensation deficiency of one or more of the primary colors would cause an endless variety of transition forms.

Although tower skull is not truly a congenital anomaly, the setting for this dystrophy and its ocular symptomatology is probably regarded as congenital.

In a recent examination of 255 blind persons, Thompson found 65 cases due to congenital causes. A number of others were probably developmental, or hereditary in nature.

There are two main theories, according to W. S. Reese[3], as to the origin of these affections, the toxic and the developmental. The toxic theory is the older, and was originated by Horner, who attributed these defects to some noxious influence. This theory was supported by von Hippel's experiments in the production of cataract by the roentgen ray. Von Hippel considered this a direct phototoxic action on the fetal eye. The de-

(3) Atlantic M. J., March, 1928.

velopmental theory was advanced by Hess who looked on these conditions as developmental defects. At the time of the rediscovery of the Mendelian theory, this hypothesis crowded the toxic theory into the background and, through the work of von Hippel in 1903, the teaching of eye anomalies entered a new phase.

Experimental teratology has shown that various things can produce these deformities, such as salt solutions of different strength, trauma, concussion, pressure, temperature variations, and chemical solutions. The fully developed eye may undergo various changes in intra-uterine life, many of which are so manifestly inflammatory that they must be regarded as due to fetal disease. The border line between developmental anomalies and fetal-disease affections is by no means sharp; indeed, fetal disease may cause these anomalies.

Certain cases are undoubtedly due to congenital disease, such as total staphyloma of the cornea, adherent leukoma, internal ulcer of the cornea, and congenital hydrophthalmos. These eyes exhibit the same changes, so far as can be shown anatomically, as are produced by disease after birth. In these cases we may admit the same cause, that is the influence of pathogenic microorganisms. The infection may be exogenous or endogenous. Von Hippel considers possible the transmission of these organisms to the embryo. How far this etiology should be considered is determined by the individual deformity. A general disease is not necessary for infection of the fetus through the mother. Disease of the uterine mucous membrane or the placenta can suffice. Nor need we suppose direct transmission of bacteria. Diffusion of chemically different substances may come into the question, especially in the young and delicate fetus.

One must also consider the possibility of the products of fetal disease hindering development at a later period, as we have no reason to suppose that fetal disease cannot arise very early. One must not for this reason drag

the idea of inflammation into the foreground. "Inflammation," says Marchand, "cannot account for the very early embryonal developmental changes, for this would presume certain peculiarities and constituent parts of the tissue which the embryo does not offer." This is certainly correct anatomically. If we speak of disease in general, however, and lay stress on an external, in a certain measure accidental, injury affecting the embryo, then we must presume that the cells themselves, in some unknown manner, will react to the irritant. Thus could arrest in growth or atypical development be partly explained. Through disease, for example, failure in closure of the fetal cleft might occur. Just as in extrauterine life, disease processes arising during fetal life could recede and leave no evidence except those which might later be regarded as anomalies of development. For this reason the lack of anatomically proved residuals in deformed eyes is not striking proof against the formation of the anomaly through fetal disease. The same eye can probably be affected at different times in its development. Certain changes, manifestly inflammatory, in the tunics of colobomatous eyes must be of later origin than the coloboma itself.

Coarse trauma can at most give rise to isolated defects, whereas long-continued pressure undoubtedly plays an important rôle. Abnormal positions of the amnion here come into the question. Van Duyse ascribes polycoria, aniridia, atypical iris coloboma, corectopia, and lens ectopia to developmental disturbances which have some pathology of the amnion as their basis.

The pure acceptance of anomalies as of germ formation, as Leber emphasizes, does not explain deficiency of one part of the eye while the remainder is normal.

Of great interest is the appearance of congenital eye defects in animals whose parents have had experimentally produced eye affections. Still more extraordinary are the eye conditions which Brown-Séquard obtained in the progeny of three guinea pigs whose restiform

bodies he had removed. They exhibited corneal, lens, and vitreous opacities, and often a gradual atrophy of the whole globe. The explanation of this is still debatable. The possibility that inbreeding plays a causal rôle must be considered. The injurious influences of blood marriages are so certain as to make one dubious as to the significance of this instance of true deformity. Laquer considers consanguinity universally accepted in microphthalmos and coloboma of the macula.

In many deformities, hereditary transmission is practically excluded. Persons with bilateral anophthalmos or cyclopia will in general not have progeny. So-called arrest of development may arise from exogenous or endogenous causes. In such cases the defect resembles some developmental phase. The only deformity which often appears in subsequent generations is aniridia. There are few cases of direct transmission of microphthalmos and anophthalmos. Numerous, on the other hand, are the cases of cataract, which, however, we might number among the disease conditions. The direct transmission of coloboma is by no means common.

It has also been accepted that eye deformities may be due to secondary changes which have their cause in a primary developmental disturbance of the brain. This is based on the fact that the primitive nerve and retina are outpouchings of the brain and the stalk of the primary optic vesicle is directly connected with the cavity of the brain. Also, as noted by Kundrat, there is some microcephaly in microphthalmos. The question arises whether the brain and the eye affections have a common cause. Certain cases speak for this. There are observations on record of chicken embryos in which, in spite of imperfect development of the brain, the eye had suffered no disturbance; moreover, one case of high-grade cyclopia of the brain and nose showed normal eyes. Here the developmental disturbance affected the brain very early without the eye showing abnormal development. A reciprocal influence is therefore not conclusive. In

anencephaly, the nerve fibers in the optic nerve and retina fail and at last even the ganglion cells. In anophthalmos the whole optic pathway fails by becoming markedly attenuated. These phenomena may without difficulty, however, be shown as secondary degenerations. That there is a direct trophic dependence of the eye on the brain is conceivable only in the earliest stages, as shown in the development of the eyes in anencephaly.

These various anomalies, not mentioned by Weinberger, are taken up more or less systematically by Reese.

The Iris. Persistent pupillary membrane is the most common iris anomaly. Statistics as to its occurrence vary considerably for obvious reasons. It is distinguished from posterior synechia by its origin from the anterior surface of the iris, usually in the region of the smaller circle, and never from the pupillary margin. The movements of the iris are usually not affected, and the lens is generally normal. These membranes may stretch across the pupil, run tangentially to it, hang free at one end, or form a loop in the pupillary space. They may, in rare instances, be attached to the lens or to the cornea. A number of fibers may unite and form a plaque in the pupillary region attached or unattached to the lens. These membranes do not usually affect vision, except those of plaque formation, and these may require operation. Those going to the cornea can probably arise either as a pure malformation or from perforation of a corneal ulcer. The ordinary types are probably malformations.

Aniridia is a condition of apparently complete absence of the iris. As a rule, some iris is present but escapes detection clinically. This defect is almost always bilateral, and might be looked upon as a total coloboma of the iris. The tendency of aniridia to glaucoma must be kept in mind. It is interesting to note that eserin reduces the tension of these eyes. The influence of heredity in aniridia is most striking, numerous in-

stances being recorded. Aniridia is undoubtedly a developmental defect.

The pupil may exhibit a number of abnormalities. Polycoria is a condition characterized by numerous openings in the iris, only one of which is the true pupil and has a sphincter muscle. Corectopia, or eccentric pupil, is occasionally seen. It may lie very close to the corneal margin. The most common type is associated with ectopia lentis. Von Hippel believes it to be due to localized fetal iris inflammation.

Coloboma of the iris is usually downward, or downward and inward; if in any other position, it is termed atypical. These types may involve a large part of the iris. The typical variety is probably developmental in origin. The reaction of the iris to light is quite variable, and depends to a great extent upon the size of the defect and the condition of the sphincter.

Heterochromia iridis is a difference in color of the two irides. Usually one eye is brown and the other blue or gray. The whole iris is not always involved; only a sector may be affected. Heterochromia occurs in two forms, one being an anomaly and the other a symptom of a definite disease. The latter has been called heterochromic cyclitis. Most writers have noticed the tendency of the lighter eye to disease. Beaumont thinks this should be expected as the iridic pigment has a protective purpose. Cataract is probably the commonest complication.

Congenital cysts of the iris are rare.

Ectropion uveæ is a condition normal to the horse, and consists of masses of pigment at the edge of the pupil. These pigment masses may appear as grape clusters. They are sometimes enormously developed, and may drop off into the anterior chamber. One must be careful not to consider ectropion uveæ as iridic adhesions or postinflammatory pigment deposits.

The Lens. Cataract is the most frequent type of lens anomaly. Congenital cataract may be partial or com-

plete, the former being much more common. The partial are further divided into (a) anterior polar; (b) posterior polar; (c) lamellar; (d) nuclear; (e) dotted. Both developmental and toxic theories are used to explain polar cataract. Pagenstecher's experiments certainly favor the toxic theory. He produced cataract in rabbits by feeding them naphthalin.

Zonular, perinuclear, or lamellar cataract nearly always affects both eyes, and is stationary as a rule. Inheritance is rather frequent. It is thought to be a nutritional disturbance, and occurs often in children who have had rickets, convulsions, or tetany. Central or nuclear cataracts are closely related to the lamellar type. Eyes affected with this kind of cataract frequently show other congenital malformations. Coppock's, discoid, or Nettleship's cataract is a peculiar hereditary familial type. Chance found it in five members of one family. These cataracts are bilateral, symmetrical, and appear stationary. They are disklike and seem to be between the posterior pole and the nucleus. Fusiform, spindle, axial, or coralliform are rare varieties, named on account of their shape or position.

Dotted cataracts are usually found in the periphery and may be bluish in color, whence the name cerulean. They are usually hereditary. Total cataracts may be fluid, soft, or very dense and limelike. These latter are thought to be due to a syphilitic intra-uterine inflammation. Ectopia lentis is a comparatively rare anomaly. It is usually bilateral, and may be familial and hereditary. The lens is usually dislocated upwards and outwards. The suspensory ligament is usually completely absent in the region corresponding to the aphakic area, and defective development of this ligament is probably the cause of the condition.

Lenticonus is an abnormal curvature of the anterior or posterior surface of the lens. It is quite rare, especially the anterior type, though this type might readily be passed by as a pyramidal cataract. Rupture of the

posterior capsule, due to increase in the size of the lens or to traction by the hyaloid artery, is given as a cause. Collins suggests that it is due to defective development of the posterior capsule.

Coloboma of the lens nearly always occurs at its lower border. It is usually unilateral, and these lenses may subsequently become dislocated. Coloboma of the zonule of Zinn usually occurs with coloboma of the ciliary body and lens. It is generally triangular, with the base at the ciliary border.

The Vitreous. Coloboma of the vitreous is represented by a cleft which may reach from the papilla to the region of the ciliary body. This cleft is usually filled with vascular connective tissue.

Persistent hyaloid artery may extend from the papilla to the posterior surface of the lens. Various intermediate varieties are found.

The Retina. Coloboma of the retina and choroid are considered together since they are so intimately associated. These colobomata are usually below and extend almost up to the papilla. They may surround the papilla and usually have pigmented edges. The condition is generally bilateral and, when unilateral, the left eye is said to be more often affected than the right. The foveæ may or may not be affected. These eyes are usually considered myopic. They are very prone to inflammatory changes and, unless examined soon after birth, it is manifestly impossible to decide whether these changes are antenatal or postnatal.

Glioma of the retina, or as Jackson suggests, "retinoblastoma," is said to be congenital in 19 per cent of the cases. It often appears in several children of the same family. The diagnosis is not always easy. So-called pseudoglioma most frequently causes error. Cyst of the retina is very rare. It sometimes occurs with microphthalmos. Retinitis pigmentosa, or pigmentary degeneration of the retina, is either congenital or begins early in childhood, although the pigmentation is prob-

ably never present at birth. It is hereditary, and has been attributed to consanguinity. It is classed as an abiothrophy by Collins. Probably a number of cases of syphilitic retinochoroiditis are improperly diagnosed retinitis pigmentosa. The differential diagnosis may be quite difficult.

Medullated nerve fibers have been regarded as congenital, though, as Fuchs states, they are really postnatal. They may be separated from the disk, though they are usually at the upper and lower borders. Congenital detachment of the retina has been described. It is thought to be luetic in origin. Congenital tortuosity of the retinal vessels may be unilateral or bilateral. It is generally associated with hyperopia.

Cilioretinal vessels are relatively common. They are usually arteries, and may be of importance in obstruction of the central artery. Opticociliary vessels are rare. They are usually veins. Coloboma of the macula is rare and is usually unilateral. Vision may be normal or greatly reduced.

The Choroid. Fuchs' coloboma, inferior crescent, or conus nach unten, is a small cresentic defect of the choroid at the lower border of the disk, not unlike a myopic crescent except in position. These eyes are often amblyopic and squint inward. An appearance of cupping may be given by these crescents, especially those of the scleral variety, so that glaucoma may be incorrectly diagnosed, or even optic atrophy. The amblyopia furthers such an error.

The Optic Nerve. Aplasia of the retina and optic nerve is seen in anencephaly, cyclopia, and in some cases of hydrocephalus. Absence of the nerve is also noted in anophthalmos and microphthalmos. Petren sought to explain this as a "system defect" affecting the neurons of a particular order.

Hole in the disk, large disk, and coloboma of the nerve head are rare anomalies.

Pseudoneuritis is seen fairly frequently.

Examination of the Eye

Health Examinations of the Eye. The development of medicine has been from efforts to cure conditions produced by injury or disease, toward the prevention of such calamities or the diminution of their effects. Cure required knowledge of the nature of the diseases and injuries; prevention demands understanding of cause, to avoid effect. Therapeutics rests on exact diagnosis: discrimination between conditions easily confused. But prophylaxis requires, in addition, a knowledge of the normal course of living processes, the possible deviations from that normal course, ability to detect the early signs of such deviations, and accurate observations of what is going on in the body before any striking departure from normal health has occurred. Medicine requires knowledge of disease, hygiene the foreseeing of it, by broad understanding of the interplay of vital processes, and by close observation of what is going on in the body when it is still apparently in health.

In our day the advance from cure to prevention is going on, more evidently and more rapidly than ever before. Safety first! is a slogan that stares at us in every railroad yard and manufacturing plant. The value of health is preached by insurance companies, and calculated by efficiency engineers. Industrial hygiene has become a great interest of corporations and communities. The medical profession, always tracing effects to their causes, with keen interest in every pathologic process and its humanitarian aspects, has for more than a century carried on quarantines and vaccination for the prevention of disease; has discovered methods, physical, chemical and biological; and has amassed an immense array of facts in the domain of individual case histories, which it is now beginning to apply. They are for the benefit of every person who has intelligence and foresight enough to avail himself of the great advantages of the age and civilization in which he lives.

Health examinations, careful observation of what is going on in the body and life of the individual, are the necessary measures for bringing these benefits to the people. The examinations are including new tests and methods of investigation, such as the tuberculin test or Wassermann reaction, basal metabolism and studies of endocrine function. They must also include all the most exact means of physical examination that have heretofore been used in the study of disease; and particularly as pointed out by Edward Jackson[4], those methods that have been developed in the last century, in the study of conditions of the eye and the function of vision.

The measurement of visual acuity, the mapping of the visual field, photography of the ocular movements, observation of pupil reactions, the testing of light and color perception; the tension of the eyeball, or the blood pressure within it, trans-illumination, the *x*-ray examination, observation of deep tissues with the ophthalmoscope, and now biomicroscopy, are all methods for health examination. They are methods in which we, as eye physicians, are already trained; and their application in formal health examination will make them more effective and valuable for the study of patients.

"If one member suffer, all the members suffer with it." We cannot know the health condition of even one small organ without understanding the health prospects of all parts of the body. We are forced to note the absurdity of supposing that the health of the eye can be intelligently looked after by those who have no acquaintance with the conditions of health for the body in general. This vital requirement of a general knowledge of health and disease makes general training in medicine essential to every true specialist. And it also gives every well-educated specialist competence in forecasting the general health prospect and needs of every patient.

Probably few have realized how many of the ophthal-

(4) South. M. J., January, 1928.

mic examinations made in the past have been strictly health examinations, in this recent sense of the phrase; examinations for the maintenance and improvement of the health of the person examined. Many examinations of persons in apparent health are not in this class. The examination of school children with reference to contagious disease is made for the prevention of epidemics; for the good of the whole community, its health interests and its business and commercial interests as well. The tests of visual acuity and color sense of railway and marine employes are made to protect the lives of those who travel, and the commercial interests of those who ship goods on common carriers. A school child is examined for visual acuity and evidence of eye strain, primarily in the interest of the child's health and welfare. Tests of color sense may be added in order that each child may know what vocations he may enter upon with safety and hope of success. Drawing this distinction between "health examinations" and other physical examinations of healthy people, such as are made of military recruits or of applicants for life insurance, let us consider some ophthalmic examinations made to secure the best health to the person examined.

It has been stated that three-fourths of the work of the oculist is the correction of errors of refraction; the measurement for glasses. Lenses may be needed because the crystalline lens has been lost by trauma, or the eye has become myopic as the result of disease. But even in such cases, the lenses are not used to restore the original soundness of the eye, but to prevent impairment of vision and further disease of the eye through eyestrain; to bring the eyes to the best condition of function and health, and keep them there. The examination of the eyes for glasses is pre-eminently a "health examination," to be repeated so often as the changes of life, or the special character of the defect, make repetition important.

The changes of requirement for accurate vision that

have come with the development of our civilization give enormous importance to this kind of health examination. The human eye is more capable of accurate and exactly adjusted vision than are the eyes of any of the other animals that closely resemble man. This has come to be so through changes in habits of living, that brought greater need for accurate vision. But these changes in visual requirement go on with greater rapidity than does the evolution of the eye to meet them. Within recent historic time, the person who could read and write was the rare exception. Universal compulsory education now demands that every healthy child shall be able to do this. Printing from movable type was invented less than five hundred years ago; and the great mass of delicate mechanical trades that demand accurate continuous vision have come into existence, or become common, within the last one hundred years. The amount of printing that invites use of the eyes, from the reproduction of ancient manuscripts to the morning paper, has increased a hundred fold within a single lifetime.

With the concentration of populations, the number who can live the life of a hunter or a fisherman becomes insignificant, although the hunter's vision still is necessary to the herdsman, the sailor, the railway engineer, the aviator. The millions crowded into cities must keep accurate their near vision; whether they are machinists, weavers, seamstresses, typewriters, clerks, bookkeepers, or following any one of the thousand urban trades or professions. The keeping down to a minimum of the labor of accurate vision is one of the most important objects of social economy, and only to be attained by health examinations of the eye.

The periodical examination of school children's eyes is a health examination that is being widely made. It is still emphasized to the public mind, as a means of preventing epidemics of trachoma or acute conjunctivitis; but it can be better planned and more effectively

urged on a community as the best way to secure the health of each child examined.

Such an examination of the eyes should be made at the child's first entrance into school, or during the pre-school age, to determine his fitness for and the proper time for his entrance upon school life. Even the simple testing of vision, the sense on which school training is mostly based, has been deferred until the second or third grade, because those who were trying to get such examinations organized and adopted could not get away from the traditional use of letters. Letter tests are still supposed to have some kind of mythical value, if they are called "Snellen letters" and used at twenty feet. But more accurate and convenient tests of visual acuity have been described in the literature of ophthalmology for more than fifty years. The Snellen "haken" (hooks), recognized as a sort of letter, under the name of "the Snellen E" (1873), the broken ring of Landolt, or international test (1885), the incomplete square suggested by the writer (1891), can all be used with children of three to five years old, and give more reliable tests of visual acuity than cards of test letters ever have given. It is a hopeful sign that through the National Committee for the Prevention of Blindness, the "Snellen E" has been put to this extremely valuable use; and Mrs. J. R. Royer is now demonstrating in different parts of the country what a practical means this is of ascertaining, at the pre-school age, the fitness of eyes for school work.

In other ways the school examinations of the eyes must be improved before they can render full service as health examinations. S. D. Risley, of Philadelphia, more than forty years ago worked out and applied to 4,000 school children a system of examinations that included, with tests of visual acuity, near point and color sense, the critical inspection of the eyes and related parts, with the ophthalmoscopic examination of each eye by a competent oculist. The ophthalmoscope opened

to ophthalmology new realms of study, new conceptions of disease, and showed new interdependence of the eye and other organs. It is essential to use the ophthalmoscope before we can assume that we are offering for the assistance of the individual all the resources of modern ophthalmology, of modern medicine, of hygiene and prophylaxis. The facts shown by the ophthalmoscope must be ascertained and utilized in every examination that attains a thoroughness commensurate with the importance of health in the scheme of modern life.

To examine the eyes of school children is not the only health examination that will be of wide benefit to them and to the health interests of the community. But it is a definite method of demonstrating the value of these examinations and people are ready to accept it as a rational precaution against the dangers which school life entails upon those who have eyes not fitted to bear the strain of continuous near seeing. The wide application of eye examinations of this kind will go far toward educating the public as to the value of health examinations. People will quickly see and accept the necessity for having such examinations made carefully by those who are competent to make them, by trained eye physicians, rather than by tradesmen who are seeking to bring their business before the public. The public will be convinced that it is as reasonable to pay for this kind of service as to pay for securing cleanliness of school buildings.

The eye examinations of children may be followed by similar health examinations in early adult life. These are particularly called for with reference to fitness to enter various lines of industry, and for women to guard the health during pregnancy. For those who need to wear glasses, re-examination at intervals of a few years is a reasonable precaution. But it is at middle age, and from then on, that health examinations of the eye are important for everyone. The beginning of presbyopia, which progresses to complete dependence on glasses for

accurate focussing, furnishes the occasion for such examinations; and the opportunity they afford for the early recognition of senile degeneration, emphasizes their importance. Angiosclerosis, beginning cataract, senile retinal changes, glaucoma and evidence by visual acuity and fields, of degeneration in the visual or oculomotor tracts, all demand that the examinations of the eyes of elderly persons for glasses shall be made a real health examination, and shall be the work of a fully educated eye physician, not of a refracting optician, or short-cut optometrist.

The question of who should examine the eye for glasses has too often been argued on the ground that the physician was allowed by law to use "drops" in the eye, while the non-medical refractionist was not. It is far more important that the physician is expected to have a broad knowledge of physiology and pathology, an understanding of biologic processes and the interdependence of the different organs of the body; or that he is not hampered or biased in his investigation of the case by the desire to make a sale of spectacles. Health of a single part of the body cannot exist without health of other parts. Healthy nutrition and innervation of other parts are essential to healthy nutrition and innervation of the eye. Health, of even so small a part as the eye, is a balance of processes and actions throughout the body, and cannot be understood except by considering its broad relations.

Accurate measurements of the eye are essential. No one with a proper sense of their importance will give ophthalmic advice without the right to use cycloplegics and mydriatrics when these are needed; but neither should he attempt it without an understanding of the breadth of the relations of visual capacity to other vital processes: the circulation of the blood, the mutual effects of innervation of different parts, the foundation of nutrition for the eye on the mechanical and chemical processes that constitute gastrointestinal digestion, and

the influence of the oxygen supplied by respiration. Too many medical men think that people who are old enough to have glasses tried on without cycloplegia can be examined well enongh by a spectacle seller. They seem wholly ignorant of the importance of recognizing the senile degenerations and vascular diseases that are exhibited to the physician who can use the ophthalmoscope or the biomicroscope, but can never be understood by men untrained in pathology, physiology and biochemistry.

Let us insist that the visual organs, the most delicate and complex in the body, need to be under the observation and care of medically trained men, and not relegated to those who merely know more about glasses than the neurologist, the internist, the laboratory worker, the dietician or the goitre surgeon. If there are periods of life when medical supervision is especially necessary, it is during the period of infancy, and when the degenerative changes of age are impending. We are learning that the ocular dangers which come with age are generally attended by need of change in glasses; and that the examination of the eyes gives the most reliable evidence regarding senile nutrition and degenerations. At the time of life when patients are most likely to follow advice as to the prevention of loss of vision, such advice should be available, based on intelligent health examinations of the eyes.

The acuteness of the light sense, and the extent and promptness of retinal adaptation, are visual powers that are subject to impairment in advancing age. They probably furnish some of the best available indications of the healthy functioning, or impairment, of the central nervous system. Tests for them, especially, applicable to people who are losing sight with age, would give valuable information with regard to real visual defects, and would also give an index of the progress of neural senile changes. The habitual application of

such tests in health examinations will make the indications they give more definite and valuable.

The loss of sight with age has been regarded, both by the profession and the laity, too much as an inevitable manifestation of senile decline. Let us have more complete information about it, and understand its real, its usual and its exceptional significance. It has been too common to find lens opacities, use the word cataract, and leave the patient waiting for a supposedly inevitable operation, a prey to the blandishments of quackery, or to his own unhappy reflections. The practice of real health examinations will give us better ability to guide patients nearer to health, and will reveal unsuspected opportunities to use this ability to the mutual profit of patient and physician.

Health examinations of the eye neither imply nor demand any unfamiliar methods of diagnosis, any manipulations or exposure that can be disagreeable or disgusting. They need no outfit of elaborate new instruments, no suspension of practice to acquire a new technic. They do imply a closer acquaintance with the normal conditions of the visual organs, a more complete knowledge of the age changes of the eyes, a closer discrimination between physiologic and pathologic conditions, a broader acquaintance with the unusual but healthy conditions of the eye. Loring said that five-sixths of the art of ophthalmoscopy is an acquaintance with the normal fundus. Such acquaintance has too often been lacking, even among oculists of long practice and large experience.

The practice of health examinations of the eye invites us to acquire greater skill in diagnoses; a broader foundation in physiology for our knowledge of ocular disease; a fuller, higher development of practical medical judgment; with a surer and more reliable knowledge of the beginnings of disease, that will detect it at the time that therapeutics will be most effective. It is no change in the field of science that we work in, but a

change in our point of view regarding the indications and courses of disease with which we are already familiar. And this change is but one instance of the shifting of viewpoint and emphasis that is going on in all branches of medicine; a turning from combat with overshadowing emergencies and declared results of disease to the understanding of the causes of disease, the foreseeing of its course, and the prevention of undesirable results.

The great importance of these health examinations depends on the fact that in the eye, finer ramifications of the blood vessels, nerve trunks and nerve endings, and the delicate processes of nutrition lie open to inspection, under magnification up to 50 or even 100 diameters. Vital functions can be studied by most delicate tests. Far-reaching coördinations here show their earliest most definite effects, samples of pathologic processes which may affect any other part of the body are here carried on, where they may be recognized in their early stages, and where the results of therapeutic measures may be followed and judged with great exactness and certainty.

The medical art of former centuries rested largely on observations of the pulse, in the radial artery. Now we can watch in the eye the circulation of the blood in the minute branches of the retinal artery, can see nerve swellings and degenerations only to be inferred elsewhere, can follow through all their stages the lesions of syphilis, tuberculosis, focal infections, anemia, poisoning and senile degenerations. Our methods for such studies are already developed. The general medical profession and the public are awakening to the value of this service. The call to those who are prepared to give that service is distinct, immediate, urgent. Let us go forward and develop the possibilities of the new situation here revealed for the prevention of disease that open up before every physician who has learned the methods of ophthalmic diagnosis. Each of us who does this is

recognizing the condition of all professional leadership and success, the continuing of his education and professional development throughout his active life.

Detection of Simulated Blindness or Ambylopia of One Eye. A new method is described by H. Lauber[5].

The patient is placed before the vertical perimeter, a prism of sixteen or twenty degrees apex up before the alleged blind eye, apex down before the other eye. The test object is held at the lower end of the perimeter and the patient asked to indicate its appearance from below. If it is seen very peripherally, e. g., at seventy degrees, the alleged blind eye is seeing. For testing the horizontal meridian the prisms are placed base out. The patient sees crossed double images, and may convince himself of it by closing one eye. If e. g. the right eye is said to be blind he knows that he must not see the left point of fixation. If the test object is moved from the right side towards the median line, it appears at first near the right point of fixation, which the patient knows is seen with the left eye. He will not hesitate to indicate the appearance of the object, but has betrayed himself because he can see the object only with the right eye. For the double images are so far apart (eighteen degrees) that that of the right eye appears to the right of the point of fixation of the left eye.

The Refraction of the Eye.

Refraction in the Very Young. Clinical problems in refraction work differ greatly in young children from those presented by adolescents and adults. We may regard the general principles of refraction and the technic of their application in adults as fairly well standardized. Probably on no other subject would the world's ophthalmologists so nearly approach complete

(5) Klin. Monatsbl. f. Augenh., June, 1927.

agreement. But in the management of eye defects in younger children there are still wide differences, both in theory and in practice. (Figs. 1 to 8.)

This is true especially of the problems occurring in the pre-school age, as pointed out by Burton Haseltine[6]. It is well understood that with the beginning of regular school work some attention should be given to the eyes

Fig. 1.—(left) Patient of three years without distance or bifocal glasses, illustrating marked convergence.

Fig. 2.—(right) Patient with bifocal lenses adjusted too low to be effective.

of every child and where defects are disclosed these should have skilled attention. This marks a great advance over the ignorance of other days, an advance due to the good educational work of ophthalmological societies and journals. The next important step is to study the problems in children of pre-school age to reach, if possible, equally wise conclusions. This means the period, say, between two and seven years of age, a time of vital importance in some cases, because the recognition and treatment of certain defects at this time will re-

(6) Eye, Ear, Nose and Throat Monthly. November, 1927.

sult in normal binocular function which may not be obtainable by any treatment at a later period.

All non-medical people and all physicians, other than ophthalmologists, are thinking too much about the time when the child first goes to school or learns to read. Two facts should be more widely understood: first, that modern children use the eyes extensively for near vision and may suffer from eye strain long before they learn reading, and second, that measurement and correction of ocular defects need not be delayed until the child has

Fig. 3.—(left) Patient wearing distance correction only. (Patient had been previously furnished with full distance correction without results.)

Fig. 4.—(right) Patient with bifocal glasses properly adjusted and the excessive convergence completely eliminated.

"learned his letters." Ophthalmologists will forgive the statement of facts so well known to them because general physicians are still so often not clear on these points.

In view of the immense importance of the time element in certain cases, some ophthalmologists advocate the measurement of refraction in all children before the age of six years. With the simplicity of modern methods

and the trifling inconvenience involved this cannot be considered an extreme view. Certainly if parents desire it, no child should be denied the benefit of positive

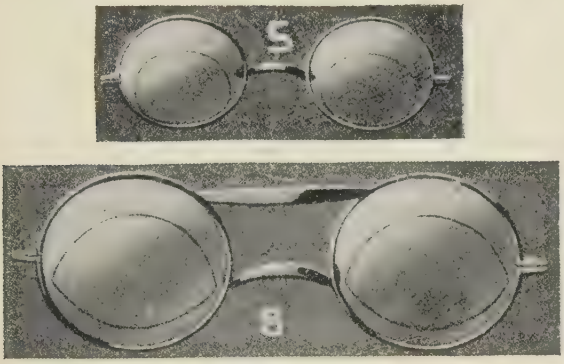

Fig. 5.—(upper) Style of bifocal glasses properly adjusted and the excessive convergence completely eliminated.

Fig. 8.—(lower) Style of bifocals worn by patient illustrated in figures 6 and 7.

Fig. 6.—(left) Six year old patient who has been wearing bifocals for one year without change in reading segment. The habit of maintaining binocular fusion is sufficiently established to warrant a reduction in the segment addition one-half diopter.

Fig. 7.—(right) Patient wearing bifocals with the excessive con-figures 6 and 7.

knowledge as to whether or not he is developing normal eye function.

Practically, however, in the present status of parental psychology the physician's opportunity will usually be limited to those children who show real or fancied evidence of eye defects. The real evidences of refractive errors at this age are few. Inflammatory conditions at this time of life are due to other causes. Impairment of vision sufficient to be observed by parents calls for most careful diagnostic study. The great danger signal in children at this age, and the one too little heeded, is a tendency to loss of parallelism. Whenever there is observed a "turning of the eyes," however transient, the parents should be told that complete eye examination is urgently needed. Eyes that are obviously "crossed," of course, scream for immediate attention. If we are asked at what age the examination should be made we should emphatically reply, at whatever age the symptom is first observed. Any child old enough to have a strabismic eye is old enough to have the refraction measured under cycloplegia with a little tact and diplomacy upon the part of the examiner. Generally speaking, the same may be said regarding the wearing of a correction. Certainly an eye that is deviating because of refractive error cannot be corrected too soon, and delay only lessens the hope of perfect function. In the cases of strabismus in children too young to have any understanding of the situation correcting glasses are accepted and in a short time these children elect to put on their glasses without suggestion.

The most frequent problem in children of pre-school age is that of convergent strabismus, either constant or intermittent. Most physicians now know that in cases of obvious strabismus delay is plain malpractice. It should also be known that the transient deviations from parallelism are almost equally urgent, especially if observed with increasing frequency. These children nearly all have refractive errors of the hypermetropic type and

usually there is an anisometropia. It is important that the defect in each eye be accurately corrected. The older teaching on this point was in error, for certainly children and young adults do wear corrections with wide differences between the two eyes and obtain perfect fusion.

It is understood, of course, that the refraction is measured by the retinoscope under full cycloplegia, and for patients of this age there is no satisfactory substitute for atropin sulphate. It must not be used with the same freedom as in adults, but complete suspension of accommodation is desirable for several reasons. First, accurate measurement is not possible without it. Second, it gives important diagnostic information as to whether the strabismus is wholly due to accommodative strain. Third, it is a helpful first step in treatment, relieving, as it does, this strain. Fourth, in the usual situation where one eye tends to be the continuously deviating one, the other may be continued under cycloplegia for a time, which will favor the trend toward balance.

In many cases the proper distance correction alone will result in the establishment of binocular vision for all distances. But others are not so simple. Frequently we have apparent binocular vision for distant objects, but partial or complete inability to use both eyes for near or middle distances. For this difficulty many forms of training have been tried with little success.

In this situation it is customary with most ophthalmologists to recommend some form of operation upon the ocular muscles. This is the only recourse for those not familiar with the work of the late Doctor George A. Suffa of Boston. Certain parts of Suffa's work are fairly well known, but his most outstanding contribution has remained almost unnoticed:—His suggestion of the use of bi-focal lenses for strabismic patients in this stage is so logical that with the classic work of Donders in mind it seems strange that no one thought of it be-

fore Suffa. Over-correction was often suggested and is still sometimes tried. But this defeats its own purpose by blurring distance vision so that the already weak impulse to fusion is lessened and often the child gives up all effort at far-seeing when the glasses are worn. Under-correction may produce fusion in far vision, but fails entirely at the distances where children's eyes are mainly used. Even the normal effort of accommodation is enough to produce excessive convergence in eyes in which the impulse toward parallelism is still feeble. Suffa's solution of this problem is to give a slight under-correction for distance and add a near segment with enough plus sphere to suspend nearly all accommodation effort. The result in suitable cases is brilliant. No other suggestion since the time of Donders has done so much to lessen the necessity for surgery in strabismic children. Certain niceties of technic are important and we still have much to learn as to the precise applicability of this procedure.

It is practical to use the correction almost as soon as the deviation is discovered. In such cases it seems reasonable to say we have avoided operation by this means.

One point not mentioned in Suffa's work, yet very important, is that the near segment must be quite different in size and position from the one used in adults. These little patients are constantly using near vision while looking in an upward direction and the small near segment in the lower part of the lens is to them almost useless. A good plan is to reverse the usual arrangement and limit the distance area to an upper segment similar to the lower segment of the adult bifocal. A crescent-shaped, narrow upper segment for distance also works well. In this way the child has a pleasant glass to wear for his most common activities and a segment for far-seeing which he uses without awkwardness or conscious effort. Indeed, we may say of a child as of any other patient, that the only correct glass for him is a glass he likes to wear. The item of unsightli-

ness is, of course, eliminated by modern methods of lens grinding. Naturally the question at once arises, how long the added near vision segment should be worn. More extensive experience is required before this can be definitely stated. It is removed by gradual reduction after the fusion habit is well established, and probably in each case this must be determined separately.

One peculiar precaution should be taken by anyone who prescribes bifocal lenses for a strabismic child. He should tell the parents that the procedure is one with which many excellent eye specialists are not as yet familiar. This prepares them for the surprise that may be expressed by someone at seeing a child wearing "old people's glasses." Without this precaution the parent may have the shock of being told that there is something weird or peculiar about the glasses or that some mistake has been made in the fitting. It is highly desirable that this really valuable procedure should receive more attention and that ophthalmologists should publish the results of its employment.

Special Uses of the Stenopaic Slit. Everyone is familiar with the use of the stenopaic disk for the detection and measurement of astigmia. By the stenopaic disk, Joseph I. Pascal[7] refers to the stenopaic *slit* disk and not to the pin-hole disk. It is true that the disk is not used extensively for such purposes, but it is nevertheless recognized as an acceptable method and occasionally employed. Relatively few, however, are aware of the fact that the stenopaic disk can be used for the detection and measurement of spherical errors, hyperopia and myopia.

The theory underlying the test is that at right angles to the direction of the slit the disk acts as pin-hole disk. It thus eliminates the imperfect focusing due to a spherical error in the direction at right angles to the direction of the slit. Whereas in the direction of the

(7) Eye, Ear, Nose and Throat Monthly, May, 1928.

slit the error will show itself by imperfect focusing on the retina.

For the purpose of diagnosing and correcting spherical ametropia, (assuming the absence of astigmia), the disk is used in conjunction with a test card containing two sets of lines at right angles to each other. The lines may be arranged in the form of a T, with the horizontal and vertical lines made up of three lines each. The spaces between the lines should correspond to a one minute angle for a 20 feet examination distance, to be used for those capable of attaining normal visual acuity, which includes the vast majority of patients. Another chart with the spaces corresponding to a larger angle, say a two minute angle, may be used for those incapable of attaining normal visual acuity.

We will now analyze how these cross lines should appear to emmetropic and spherically ametropic eyes, when viewed through the stenopaic disk. Before proceeding, however, we may remind the reader of the genral principle that the clearness with which any line is seen depends upon the refraction of the meridian of the eye at right angles to that line. Thus if a vertical line on the test chart is seen clearly, it shows that the horizontal meridian of the eye is in proper focus, and similarly if a horizontal line on the chart is seen clearly, it shows that the vertical meridian of the eye is focusing properly. This, by the way, is the reason why in correcting astigmia by the line-chart we place the correcting cylinder with axis at right angles to the clearest lines.

We now choose for illustration first an emmetropic eye. The disk is placed with the slit, say vertically, while the patient views the T chart. The horizontal lines will be seen clearly because the vertically exposed meridian is focusing properly. The vertical lines will also be seen clearly because in the horizontal meridian the disk presents a pin-hole opening and produces good focusing, though, in this case as the horizontal meridian

is also emmetropic the focusing is not improved. We may add that the lessened amount of light entering the horizontal meridian will be balanced, more or less, by the greater aberration incident to the full exposure of the vertical meridian. Therefore, in emmetropia, both limbs of the T will appear about equally clear as seen through the disk. If the disk is placed with the slit in a horizontal direction, a similar line of reasoning will show that the emmetropic patient will see both lines of the T chart equally clear.

Let us now consider a case of manifest hyperopia. The disk placed, say slit vertically, will cause the vertical lines to appear plainer. For the vertically exposed meridian will be out of focus, causing a blurring of the horizontal lines. In the horizontal meridian, the hyperopia is neutralized by the pin-hole effect of the stenopaic disk and good focusing is obtained. This will make the vertical lines stand out plainer. Exactly the same phenomena will result if the eye is myopic.

To sum up, therefore, if the patient looking through the slit, placed either vertically or horizontally, sees both limbs of the T chart equally clear, the eye is emmetropic. If he sees one set of lines plainer, the eye is either hyperopic or myopic. We then place plus or minus spheres until we get the strongest plus or the weakest minus that equalizes the line on the T chart. The plus or minus sphere which thus equalizes the lines as seen through the disk measures the amount of hyperopia or myopia. Thus equalizing the clearness of cross lines may be made to measure a spherical error as equalizing the clearness of cross lines in other tests with cylinders is used to measure an astigmatic error.

While the practical application of the method described may not always lead to perfect results, no one method does, the principles underlying the method are perfectly sound. As a whole the test is rather simple, useful for literate and illiterate, and is certainly good as a first approximation.

What Glasses Shall We Prescribe After the Examination? R. H. Cowley[8] calls attention to a few of the pitfalls into which a busy oculist may easily fall. They are the points where the man of small experience who is painstaking and conscientious may excel in his results the eminent specialist whose mind is on the weightier matters of the law and who hurries over his refractions or relegates them to an assistant.

It will not be wasted time if we consider briefly what glasses we should prescribe after we have made the examination. Fitting glasses is perhaps the most important single thing that an oculist does, and really it requires a degree of skill and judgment quite as great as is required for the eye operations. One would not think of guessing about an eye operation, for the results of failure is calamity to the patient and loss of prestige to the doctor, results too serious to be risked lightly. And yet there is nothing which brings more discredit to the oculist today than glasses carelessly fitted. The danger with all of us is that we shall depend on our experience instead of depending on careful, patient work in coming to our conclusions. Fitting glasses is a tedious nerveracking, time consuming job and anyone experienced or inexperienced who tries short cuts is "pretty apt to lose out in the long run."

It is obviously unnecessary to go over the steps of the examination, we all know what they are. Let us first consider the strength of the plus lens which should be prescribed in hyperopia. There is no fixed relationship between the total hyperopia as found under the mydriatic and the lenses required to give comfort to the patient.

The object we have in mind in prescribing plus lenses in hyperopia is to relieve the strain and the accommodative mechanism. Whether we believe Helmholz's theory as to this mechanism or not, we do know that the accommodation is accomplished in some way

(8) Kentucky M. J., October, 1927.

by the contraction of the ciliary muscle, and when a person has hyperopia the ciliary muscle is overworked and becomes exhausted or hypertropic or both. The overstrain on the ciliary muscle depends on two things, the amount of hyperopia and an intangible personal element in the patient which differs in different patients just as does their ability to resist colds and digest pork and beans. The practical question for us to ask is not how much hyperopia has this patient, but how much of it must we correct in order to relieve the ciliary muscle and give comfort to our patient.

The answer which some very good men give to this question is that nearly all of the hyperopia must be corrected if we are to relieve the strain. Most of us think otherwise for two reasons: First, this answer is not theoretically correct, and second, it is not practically workable. The ciliary muscle like any other muscle has a large reserve and is capable of much more work than is normally required of it. Just as the biceps can be trained to lift a much greater load than is ordinarily required of it, so the ciliary muscle can do the same. Many people with a high hyperopia are perfectly comfortable so long as no sudden demand is made on their accommodation. If such a hyperope enters college or takes a position as bookkeeper he is very apt to suffer, the amount of the suffering depending on the two factors named and being different for different individuals. If he follows some vocation where he does not have to apply himself to close work he gets along very comfortably without glasses. An adult with two diopters of total hyperopia will have a manifest hyperopia of from one-half to one diopter, seldom more than this. If his total hyperopia is four diopters, he seldom has a manifest of more than one twenty-five or one-fifty diopters. The remainder of the hyperopia is taken care of by hypertrophy of the ciliary muscle. We see this hypertrophy if we study microscopic sections of hypertrophic and myopic eyes.

When such a person accommodates for close work he must accommodate the three diopters which any normal person must use plus the amount of his manifest hyperopia. The strain comes from the added effort he must make to overcome this manifest hyperopia. If then we correct the full amount of the manifest hyperopia, we have given him the full amount of relief which it is possible for him to get from plus lenses. If we give lenses which are stronger than this we dim the distant vision, the patient is uncomfortable and in most cases will not wear the glasses. If we give glasses which just correct the manifest hyperopia the patient is comfortable, wears the glasses gladly and when we test the eyes a couple of months later we find that the rest which we have given the ciliary muscle has led to its relaxation and we can usually increase the strength of the lenses until the patient is wearing from two-thirds to three-fourths of his total hyperopia. This seems a much more rational way of handling these patients than to compel them to wear lenses which are uncomfortable hoping that the ciliary muscle will eventually relax to fit the glasses, a thing which it does not always do. These patients drift to the optometrist and a comparison is made between the cleverness of the optometrist and the oculist to the detriment of the latter. However unfair this may be, it happens too often. It is very difficult to convince the average human that glasses are good for the eyes when the vision is better with the glasses off than with them on. Even if the oculist by virtue of his prestige and insistence is able to persuade the patient to wear the glasses, he has taken the less effective of two ways to accomplish the result. Just as in business, it is best to follow the slogan, "The customer is always right," so in this matter the patient is always right.

Of course there are some cases of what we call spasm of the accommodation where even with a high total hyperopia there is no manifest hyperopia at all. The

patient may even see better with a minus lens. These are the cases which make the examination under a cycloplegic so necessary. We often see such patients wearing minus lenses which have been given them by some optician. The eyestrain in such cases may be similar to that which is often found in people who have no hyperopia or visual defect at all. Where no manifest hyperopia is present, glasses will not give relief. Such patients must be advised to rest their eyes completely for a long enough time to let them thoroughly relax. Of course it is understood that we are speaking now of simple hyperopia. Where there is astigmatism, muscle imbalance or a hypersensitive retina, cylindrical, prismatic or viopake lenses may be needed to correct these difficulties but not for the hyperopia.

The author's routine is to do a pre-cycloplegic test which gives a reasonably accurate idea of the correction needed. A cycloplegic is then used and the eyes refracted accurately with the retinoscope. When the eyes have completely recovered from the cycloplegic a post-cycloplegic test is made and the patient is given the strongest lenses with which he can see as well as with the natural eye. Where astigmatism is present this is first corrected and a plus lens is given with which he can see somewhat better than with the natural eye. Where the patient has come from a distance and cannot return for the post-cycloplegic test, as careful a determination as possible is made of the amount of the manifest hyperopia before the cycloplegic is used.

Another point on which our best men are not agreed is the question of prescribing prisms where there is muscle imbalance. Some men almost never prescribe prisms, and some doubtless prescribe them too freely. In moderate degrees of esophoria accompanied with hyperopia it is best to correct the hyperopia as fully as possible and try it without the prism, explaining to the patient carefully what you are doing and telling him that it may be necessary to add the prism later. With higher

degrees, that is in those that show the eyes under cover, it is best to add the prisms to the lenses from the start. Where there is hyperphoria which is shown by repeated examinations to be constant, it should be partly corrected from the start. Just how strong a prism should be used for the correction of hyperphoria is a matter for experience and judgment and cannot be determined by rule of thumb, but good results are usually obtained if about two thirds of the hyperphoria is corrected by prisms. An exophoria will usually require no prism unless it is of rather high degree, for here the muscles lend themselves to rest and exercise much better than in the case of the other phorias. Where an exo- or eso-phoria is combined with hyperphoria, the easiest way to arrive at the prism strength and the direction of the base is to put the lenses into the trial frame at the patient's pupillary distance, select the strength of the prism needed, and make the test of the muscles, rotating the prisms until one gets the results desired.

Some men are quite enthusiastic about the results they get by exercises in their phoria cases. The author has never succeeded in getting satisfactory results in the phorias by exercises.

Another pitfall is the axis of the astigmatism in elderly people. We are apt to think that the axis does not change after the age of 55 or 60, but this is not always true by any means. This happens often enough so that it is the part of wisdom to check the axis carefully whenever the lenses are changed in elderly people and even after they have their full reading correction.

Another point that we must watch, especially since most of our patients insist on wearing horn frames, is the pupillary distance. The width of the bridge of the nose determines very largely the pupillary distance of the frame while it has no relation to the pupillary distance of the patient. When the lenses are not very strong this is of little consequence, especially if the

prismatic effect produced merely reduces slightly an exo- or eso-phoria, but where the patient wears a very strong lens, say a plus 2 or 3 for distance and an added 2.50 for near vision, the prismatic effect produced by even a few mm. difference between the eyes and the glasses may make serious trouble. It is best in such cases to put the lenses into the trial frame at the pupillary distance they are to occupy on the face and then test the muscles. We should order them decentered to meet the condition that is found. In any case one should not take it for granted that the prescription has been properly filled, but should carefully check each pair of glasses before they are given to the patient.

One last point: Not infrequently people are seen wearing strong cylinders in an eye glass mount with a spring nose piece. In one case where the nose was very narrow the glasses dropped downward until they were near ten degrees off the proper axis. The lenses had been fitted by a thoroughly competent man and were a perfect fit as far as the lenses went. The way they are placed on the face made them worse for the eyes than no glasses would have been. Where astigmatic lenses are prescribed one must always explain to the patient the nature of the lenses and the importance of keeping them straight in the frame and on the face. All these little points take time and are easily neglected in the hurry of a busy practitioner.

St. F. McDuffie[5] states that it is not always that the eyes are tired and strained from the lack of suitable glasses to correct *refractive errors*. In many cases we find that strain, headaches, postural conditions, continue after the eyes have been refracted time and time again by men of repute. It is in these cases that an accurate muscle balance test should be done which will reveal either an excess, or a weakness, of one or more of the muscles governing the eyes.

(5) Bull. Davis-Fischer Sanatorium, January, 1928.

Every eye examination to be complete should include such tests but they are more than often overlooked. The correction of such muscular imbalance is of such benefit to your patient that it should never be slighted.

Much of the occipital dull headache which is relieved by the pressure of the hand on the back of the neck and much of the running together of type in reading, as well as sleepiness from continued eye work, is due to muscular imbalance.

[It is not an uncommon thing to see patients whose symptoms are due almost entirely to weak adductive power; where the internal recti need "toning up." While experience has shown that prisms with the bases placed laterally cannot be worn with comfort for any length of time, many of us can testify that we have obtained marked benefit from prism exercises when properly prescribed.—Ed.]

Prophylaxis of Myopia. E. Holm[9] emphasizes the limitation of near work among school children and students as the most important means of preventing myopia. The facts of myopia seem to fit very well the theory that the tonus of the ciliary muscle is the regulator of the growth of the eyeball. If this tonus is increased by excessive use of the eyes for near, there is a corresponding disturbance in the development of the eyeball and hence myopia. In the schools of Copenhagen, the students who take the language courses develop a definitely higher percentage of myopia than do those taking the scientific courses, respectively 43 and 32 per cent; the language courses calling for much reading. Improvement of the general health is also a factor in the reduction of myopia. That preventive measures are effective is shown by statistics from Sweden, where in the eighties 50 per cent of those attending school developed myopia, while late reports show that only twenty per cent have acquired myopia.

(9) Hospitalstid., February, 1928.

Head Tilting and Turning of Ocular Origin. Head tilting of ocular origin was first described, according to Bielschowsky, by Cuignet in 1871, and more fully described by Landolt in 1890. Since then much has been written and many cases reported. Much that has been written has, from all appearances, been copies from previous works and is not the result of personal observations.

Whitman's textbook on Orthopedic Surgery describes ocular torticollis as an improper attitude of the head rather than a torticollis, and classes it with the acquired forms of torticollis. It is true that in only one of the large number of cases observed was a true torticollis, with the contracted sternomastoid, associated with an ocular paralysis that would probably have caused the head to tilt in the same direction. Which element was the primary lesion could not be definitely proved; but from the infrequency of this finding, it is probable that they were two independent congenital anomalies or lesions acquired in early life. In further explanation of this condition, J. W. White[1] goes on to say, the act of head tilting seems to be a combination of visual and neuromuscular impulses. There is every evidence that the desire for binocular vision is a strong impulse. There are many cases, however, where with one eye markedly amblyopic, or, in one case, without even light perception, the head tilt was the same as that resulting in binocular single vision. There seems here to be no other explanation but that of muscle sense.

From earliest childhood there is a strong aversion to any misalignment of the visual axes. This is seen in babies a few months old who keep one eye shut much of the time or who hold the eye shut with their fists. This condition of monoblepsia is quite frequently seen in adults as well as in infants. (Figs. 9 to 13.)

(1) Am. J. Surg., January, 1928.

Figs. 9 and 10.—The head tilt most frequently seen, compensating a paralysis of the superior rectus muscle, either congenital or acquired; in both cases shown the origin is congenital.

There are two conditions causing head turning that should be mentioned in passing; the first is that present in some cases of nystagmus. Here the head is turned so as to put the eyes in the field of the slower component. The second condition is the head tilt not infrequently seen in uncorrected cases of high astigmatism. The tilting here seems to result in somewhat better vision.

The torticollis due to ocular muscle paralysis is the variety most frequently seen.

Lateral curvature is not infrequently found in cases of true ocular torticollis, and it is to determine the presence of any tendency to this that the ophthalmologist should seek the aid of the orthopedist. The shoulder on the side toward which the head is tilted is frequently lower than the other, and definite histories of this condition being noted by tailors and dressmakers are commonly obtainable.

The general rule applying to the lateral rotators is that the head is turned toward the field in which the paralyzed muscle should work. So, in the case of paralysis of the right external rectus or left internal rectus, the head is turned to the right, and in a paralysis of the left external rectus or the right internal rectus, the head is turned to the left. There seems to be no exception to this rule.

The usual rule regarding elevators and depressors is that in right hand elevators and depressors, namely, the right superior rectus and right inferior rectus, the left superior oblique and left inferior oblique, the head is turned to the right; and in left hand elevators and depressors, namely, the right superior oblique and right inferior oblique, the left superior rectus and left inferior rectus, the head is turned to the left. There are so many exceptions to this rule, however, with such definite proof to substantiate them, that this is not a safe rule to follow.

The head is usually tilted back in a paralysis of an

elevator, thus putting the eye in the field of the depressors. The reverse is true when a depressor is paralyzed. Whether the head tilts to the right side or to the left side, does not depend on whether the muscle is a right

Fig. 11.—(left) Congenital paralysis of both the superior rectus and inferior oblique muscles of the right eye. The head is tilted back to enable use of eyes in lower field, where the patient has single binocular vision.

Fig. 12. (right) Head tilt compensating a paralysis of the right superior oblique.

side or left side elevator, as formerly stated, nor does it depend on the torsion effect of the muscles. The study of many of these cases gives every evidence that the head is tilted toward the side of the higher image. For

example, if the right superior rectus is paralyzed, the image seen with the right eye will be the higher. Now if this is associated with an homonymous diplopia, the head will be tilted to the right shoulder. If, however, there is present a crossed diplopia, the head will be tilted to the opposite shoulder.

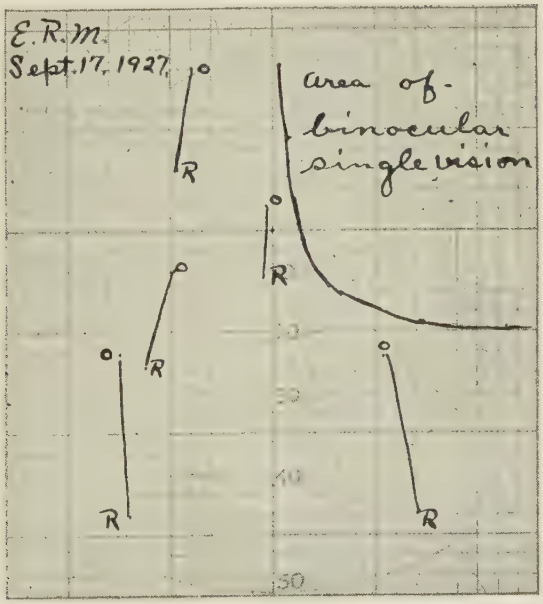

Fig. 13.—Diplopia chart in a case of head tilting due to a paralysis of the left superior rectus. The head was turned so that the area of binocular single vision was used when looking straight ahead and slightly down.

Occasionally is seen a paralysis of the same elevator or depressor in each eye. This is usually congenital and results in a head tilt only when one muscle is more paretic than its fellow. Not infrequently the head is not only tilted to one shoulder, but may be turned to the right or left, and tilted either forward or backward, thus being turned in three different planes.

The treatment of these cases by the ophthalmologist consists in either the use of prisms, or in some operative intervention. Cases of low degree of vertical deviation are at times relieved by prisms, while the higher degrees require an advancement of the paretic muscle or muscles, a tenotomy of the overacting muscle or muscles, or some combination of these procedures. Some cases are better left alone to continue their head tilt. This can usually be determined by carefully studying the case as to fusion sense and diplopia fields.

As causative factors of muscle paralysis, syphilis is the most common, although not in the proportion once claimed. Epidemic encephalitis, anterior poliomyelitis, diphtheria and many toxic conditions are frequently found to be the cause. Some are of traumatic origin. Many are congenital and are divided into two groups: (1) those resulting from an anomalous condition of the muscle itself; and (2) those due to anomalies of the ocular motor nuclei.

Cases of ocular torticollis are much more frequently seen than is usually supposed and require the combined attention of both the ophthalmologist and the orthopedist.

Management of Strabismus. The time to treat crossed eyes is when they begin to cross. More poor advice is given on the subject of strabismus than on any other condition. Lawrence Post[2] voices the experience of every oculist, that it is an extremly common thing for parents to tell us that their family physician had advised waiting until the child had reached school age. This is because of a failure to appreciate that after a year or two of deviation little more than a cosmetic result can be obtained and the most important factors, namely, good sight in the affected eye and the development of the fusion faculty, are usually beyond recall by that time.

Another caution: if one does not want to be wrong

(2) J. Missouri M. A., November, 1927.

ninety per cent of the time, he should not tell the parents that the child will outgrow the trouble without doing anything about it.

Consider the cause of strabismus in a great majority of cases. There are two important functions to be acquired by the eyes: (1) accurate vision with each eye; (2) the ability to use the eyes together. The former is of biologically early development while the latter is late. Under adverse conditions the one acquired late will be the first one discarded. Usually a baby's eyes coordinate uncertainly until about six weeks after birth. At that time if a large bright object is moved before the child the eyes will follow it. Deviations prior to this period, unless constant, are not to be especially regarded.

Later than this a frequently recurring strabismus should be investigated. The pupils should be dilated with one per cent homatropin and the eye grounds examined for tumor, choroiditis, congenital cataract, etc., because any factor which interferes with clear vision in one eye will tend to prevent fixation of that eye.

Assuming these factors to be absent, the most frequent cause of deviation is a large error of refraction. The turning sometimes follows an illness, or a severe fall or any cause that reduces the bodily resistance Often there is an inherited weakness of the eyes, especially of errors of refraction or strabismus. In these cases the subconscious mind of the infant finds so much difficulty in vision that it cannot make the extra effort necessary for coördination and parallelism of the eyes with all the very complex mechanism of concomitant movements. For this reason the effort at fusion is abandoned and the better eye chosen for use. Following this the other eye turns in or out, up or down, depending on the relative strength of its recti. In case the two eyes have approximately equal error of refraction there probably results an alternating strabismus.

It is at the earliest moment of definite crossing that

treatment should be begun, entirely irrespective of the age of the child. If this is not done the crossing eye will not develop its normal functions, just as an unused muscle will fail to develop. Assuming the crossing to be beginning at some time during the first year, can anything be done? Most assuredly yes. Two courses are open: (1) the use of an occluding pad over the fixing or straight eye; (2) the instillation of atropin in the fixing eye to blur the images in this eye and thus encourage use of the crossing eye.

In cases of alternation of the fixing eye atropin should be used in each eye. This relieves accommodation and thereby relaxes convergence, as these are associated activities and relaxation of one relaxes the other also. From then on everything is to be done to encourage use of the lazy eye.

As early as the second year a reasonably accurate retinoscopy can be made and glasses prescribed. At this point it is probably best to prescribe the full correction as found under atropin unless this proves to cause so much blurring that the child persistently looks around the lenses in which case the lenses must be reduced to tolerance. Through this year, if the eye still crosses, atropin in the fixing eye and the daily use of the occlusion pad for not less than two hours should be continued. Near the end of this year it will be possible to teach the child the names of simple pictures in outlines, such as chairs, balls, stars, etc. Visual acuity can then be determined. If this is now, as it should be by this time, not less than one-third or one-fourth of that in the fixing eye, it is advisable to put such a strong glass on the fixing eye as to fog it equally or more than the crossing eye, thus encouraging the use of the poorer eye. In case the vision is less than this further efforts should be made to increase it, continual occlusion of the fixing eye being sometimes necessary.

The next step is to produce parallelism, if not yet obtained, by use of the amblyoscope, an instrument so

constructed that images seen with each eye can be superimposed. After this has been done the barrels of the instrument are then separated or brought nearer together and the child taught to hold the images in position. This requires ocular muscular effort and can be used to stimulate the weaker muscles. As early as possible, exercise for the weak muscle should be instituted, such as the following of an object into the extreme positions for the greatest action of the muscle. For example, if the strabismus is convergent the weak eye is rotated outward as far as possible ten times, twice a day.

Next, fusion is developed by exercise with the stereoscope, depth perception being thus encouraged. Once this fusion faculty is gained there is much less danger of later crossing of the eyes. Fusion is like swimming, once learned never forgotten. But, and here is a very important point, it can almost never be acquired after six years of age. Therefore, it is utterly essential that all these steps should be begun at the earliest possible moment.

The parents who wait until late must be told that probably the eye can be straightened by glasses or by operation, but that they have waited too long for the restoration of good vision in the crossing eye and the development of the very valuable function of depth perception. Start the treatment of strabismus as soon as deviation is noted and you can safely promise much; but wait a few years and you can safely promise nothing.

Strabismus as a Symptom in Congenital Syphilis. The incidence of such eye conditions as interstitial keratitis (corneal opacities) and, to a lesser degree, of optic atrophy, or congenital syphilis, is well known. Paralyses of cranial nerves are frequently listed in textbooks as lesions of the nervous system in this disease. Strabismus by itself is not mentioned as a symptom of congenital syphilis in most of the textbooks of pediatrics and syphilology. Strabismus of one or of both eyes

in acquired, adult syphilis of the nervous system is, of course, well known as a presenting complaint, or symptom.

In the last year L. B. Dickey[3] has seen twenty-seven patients with late congenital syphilis. Of these, seven, or about 26 per cent, had evidence of strabismus, and in two it was the complaint for which the patient visited the clinic. In two the spinal fluid gave a positive Wassermann reaction; in five it was negative. The blood Wassermann reaction was positive in all seven patients. Of the five having negative spinal fluids, there were three in whom no other eye conditions were found; in one there was present a spotted, pigmented fundus, such as is often seen in congenital syphilis; in the other there were present corneal opacities (interstitial keratitis) and retinal atrophy. Both of those with positive spinal fluid Wassermann reactions had optic atrophy, one being severe, one peripapillary only. The last mentioned patient had, in addition to the peripapillary atrophy, corneal opacities as well.

In two of the cases the blood Wassermann reaction was taken because of the strabismus as a presenting complaint, and the other eye lesions were not suspected or searched for until the return of the positive blood Wassermann report. The youngest of the seven patients was 3½ years of age; the oldest was 14.

During the same one year period Dickey observed cases of strabismus in children in which syphilis was not associated, but because it may occasionally be due to or associated with this disease, he enters a plea for a blood Wassermann test on every child suffering from strabismus.

Practical Application of Orthoptic and Fusion Exercises in Subnormal Accommodation, Amblyopia and Strabismus. To obtain and maintain efficient and comfortable binocular vision, we must have fusion. There must be a simultaneous nerve impulse coordinating the

(3) J. A. M. A., Feb. 4, 1928.

extrinsic muscles and causing them to adjust themselves so that rays of light can fall on corresponding areas of the retina. We must also have an equal accommodative effort, so that when rays of light focus on the retina, equal nerve impulses will be transmitted to the brain cortex. The efferent nerve impulses stimulating convergence will then be in their proper proportion. Factors that interfere with this are numerous and diverse. Refractive errors and heterophoria are important elements, but as we study anomalies of vision and asthenopia, especially in children with subnormal accommodation and amblyopia, we are impressed with the fact that other elements need our attention. The psychic and mental element of vision is the most important, but is the least understood.

We can give much study to the subjects of perspective (Maddox) projection, and ocular orientation (Duane); also to the numerous phases of retinal stimulation, the neuro-muscular reflexes, the gradual increase and decrease of visual sensation, and to retinal and cerebral stimulation and fatigue. The case reports will demonstrate their clinical aspect. Examination of the visual fields with the perimeter and the campimeter will map out pathologic areas of the retina, but we find a number of cases, especially in children, in which the condition seems to be largely a lack of development. In these cases, the vision of the two eyes may be equal or nearly so, and while no pathology can be demonstrated, there is little or no improvement with glasses. In unequal eyes, binocular vision is not maintained. The poorer eye suspends vision partially or intermittently, and this condition is termed suspenopsia. If the condition is exaggerated until little or no vision exists, it is called amblyopia ex anopsia (amblyopia of nonuse). As we study suspenopsia and its relation to asthenopia, we are impressed with the great number of cases which lack the ability to maintain comfortable binocular vision and fusion if the eyes are subjected to much use. This

is particularly apt to occur if the refraction or accommodation of the two eyes differ, especially if the patient is debilitated. Testing or treating fusion by means of rotary or loose prisms is unsatisfactory, due to the frequent presence of suspenopsia.

If we are to obtain other than a cosmetic result in the correction of strabismus, we must develop some degree of binocular fusion. It is doubtful, unless some degree of fusion exists primarily, that it ever can be developed. In the majority of cases, it has existed to some extent and can be restored partially or wholly. There are many factors that cause or influence heterophoria or heterotropia, and all must be studied out. Errors of refraction in the two eyes are of great importance and must first be corrected. No child is too young to have this done with cyclopegia and retinoscopy. In many cases, this will suffice to correct the fault. If the visual axes are not parallel and have remained so for a considerable length of time, fusion exercise alone is not apt to succeed. Otis Wolfe†, who has made an extensive study of these conditions, believes that if the strabismus does not improve after cyclopegia, the case is not one caused by excessive convergence and accommodation alone, but that anatomic factors are present which necessitate operative treatment also.

It is probable that most cases of comitant convergent strabismus were alternating in their inception. As we study alternating strabismus, we find many of them with normal vision or slight refractive errors when either eye fixes. This is well shown in the following case, that of a man thirty years of age (Fig. 14) : alternating strabismus since early childhood, never could control eyes, and chagrined that he could never tell which one was fixing. Exam.: Vision 18 15 both eyes. Would accept only sp. plus .25 and cyl. plus .25 both under cyclopegia. Shows 25 degrees convergence. No fusion present. Operation : Advanced right external rectus. Fused lights

(†) Eye, Ear, Nose & Throat Monthly, February, 1928.

at 20 feet. Maddox test shows orthophoria at near point. With stereoscope, fuses F and L to E but not small letters. Could fuse up to G5 (Wells). One week later, fuses small letters in chart C8 and G8. Did Herring drop test two weeks later. He returned to his office work three days after the operation. Figure 15 taken three weeks after the operation. No glasses worn.

Binocular fusion cannot take place if anatomic factors are present so that the eye cannot fixate and effect simultaneous retinal stimulation (central fixation). This is

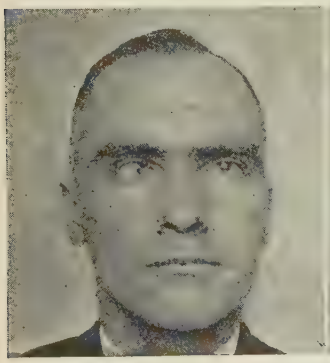

Figure 14.

Figure 15.

illustrated in the case of a girl of 16, whose eyes began to cross, when 4, after whooping cough. At 10 effort was made to straighten her eye with glasses, without success. Strabismus has alternated, but the tendency now is for the right eye to fix (Fig. 16). Vision, right= 20/20; left=20/20. Under cyclopegia, shows plus 2.00 sp. both eyes. Ten degrees accommodation in each eye, but no fusion present. Intermittent suspenopsia left eye shown with stereoscope; 35 degrees deviation when fixing with right eye. Operation: Advanced right externus 20 degrees and left 15 degrees under local anesthesia. Next day fused lights at distance, F and L stereoscopically, but not small objects. Two degrees hyperphoria

present, but this disappeared in ten days, when she showed 2 degrees esophoria at distance. Fusion and stereoscopic exercises. Six days after the operation, she could fuse small letters G1 to G7. Two weeks later, she could do the full series. Herring drop test positive. Six weeks after operation, vision and accommodation were normal. Glasses discarded. (Fig. 17.)

Another case shows remarkable improvement in vision after correction of the strabismus. Figure 18 shows a

Figure 16.

Figure 17.

four-year-old boy whose left eye had crossed since five months old. Exam.: Convergent strabismus 30 degrees. Vision right 12/30; vision left fingers two feet. Atropin and retinoscopy gave right sp. plus 2.50 ⌒ cyl. plus .50 axis 90. Left sp. plus 3.50 ⌒ cyl. plus .75 axis 60. Did not improve the strabismus. No fusion. Advanced left external rectus under general anesthesia. Very small atrophic muscle, attached well back on globe. After five months he could fuse large objects well, and small ones with difficulty. Eyes straight. Vision with his glasses, right 20/20 and left 20/20 minus. (Fig. 19.)

Treatment of Amblyopia ex Anopsia and Functional Amblyopia. The methods commonly used to overcome amblyopia are to bandage or atropinize the good or fix-

ing eye. This is good as far as it goes, and it should be utilized to some extent, but it utterly ignores binocular fixation and fusion. It demonstrates its deficiency, if persisted in, by ofttimes converting the fixing eye to the converging one. It does, however, serve the purpose of demonstrating that most or all comitant convergent strabismus are alternating in their inception, and the lack of the fusion element. In dealing with the functional amblyopia of children and young adults, we must also develop perspective, projection, and stimu-

Figure 18.

Figure 19.

late the retinal fields, as well as endeavor to restore binocular fixation and fusion in the phorias and the tropias. If suspenopsia exists, as it very frequently does, we must develop and train the secondary visual centers. In strabismus, we must also deal with the complicated mechanism existing between these factors, accommodations, and extrinsic muscles.

The Worth amblyscope has a distinct place early in developing these cases, but the Wells system of stereoscopic exercises with the phorooptometer will do more to stimulate all of the desired elements. The strong lenses of the stereoscope hold accommodation in check while

fusion is incited. Wells has elaborated on the works of Javal and others. The perspective element, which is very important, is given special attention. The brain views images much like the stereoscope: the retinal pictures are blended into one image. The visual act is a threefold affair, muscular, physiologic, and mental, but largely mental. In utilizing the Wells charts, we are able to stimulate the mental process of vision, while at the same time we can keep an accurate record of the amount of stimulation that we are obtaining in the visual centers of the brain. The aim of stereoscopic exercises is to restore, first, binocular vision, and then if possible develop stereoscopic vision. We cannot have perspective if suspenopsia exists, and therefore stereoscopic vision cannot be obtained. The existence of suspenopsia is immediately noted when using the Wells charts. Prism exercise with the Hazen krotometer will accomplish it, but as it is quite complicated, it is almost necessary that it be operated by the oculist himself.

In conjunction with the Worth amblyscope and the Wells stereoscope, Wolfe has devised an exercise which he believes is original with him. He states that this exercise is easily carried out, and if persisted in, seems to have a far reaching effect. All other exercises for fusion are to the near point, where accommodation is bound to be utilized to a more or less degree, which is admittedly undesirable, especially in convergent strabismus. The exercise is as follows: After the good eye has been covered for about an hour, it is unbandaged. A Snellen chart or picture chart for children is placed where illumination is good. A piece of cardboard is held before the good eye, and the patient views the smallest line of letters he can plainly read at a distance of ten feet or more. He is told to move slowly backward, keeping his vision fixed on the letters. As soon as he loses the letters, he is instructed to step forward until he catches them again, and then to go slowly back-

ward. Each time the letters begin to blur, he uncovers the good eye for a second and immediately recovers it. He must be cautioned to be fixing with the poor eye when he uncovers the good one. This is repeated several times. When he is fatigued, the eyes are rotated in a circle and the above process repeated. Children are encouraged to study the relative size of the pictures and of the letters in the different lines. With this procedure, we are utilizing perception, projection, perspective, and are stimulating binocular fixation and fusion with a minimum of accommodation and convergence. For amblyopia of convergent strabismus, the correcting lens should be worn. Carefully regulated atropinization or partial fogging of the fixing eye are useful in difficult cases. In hyperopes with divergent strabismus, accommodation and convergence should be stimulated as much as possible, i. e., exercise begun at near point with the correction left off. The above exercise is also beneficial in certain cases of myopia.

Nystagmus. In a symposium on nystagmus[4], B. Chavasse divided nystagmic movements into jerking and smooth; after which terms like unilateral, associated, latent, horizontal, torsional and their opposites were permissible. Nystagmus may be considered as a disease, a symptom, an adaptation, a habit, or a neurological phenomenon. As a symptom it brings up questions of irritative or destructive lesions and their location. In adaptation, as for seeing in dim light, it differs in degree from normal sight movements. As a habit it needs thorough treatment. Its basis is essentially an obstacle to normal complete vision, producing a struggle between physiologic actions.

H. E. Jones based classification on the nerve tracts participating in the nystagmic movements. Pure "ocular nystagmus" is a pendulum movement to and fro at equal speed. Even with vision improved by corrected refraction, it generally continues throughout life.

(4) Tr. Opth. Soc. U. Kingdom, 1927, v. 47.

Railway or normal nystagmus is induced by watching objects from a moving car, or a revolving drum in the laboratory. The eyes move to watch one object, then quickly revert to their position to watch another. Miner's nystagmus, excluded from this discussion, was referred to for comparison, as having to and fro movements of equal speed. In vestibular nystagmus the direction of the movements are related to the planes of the semicircular canals. Pontine and cerebellar nystagmus is essentially a conjugate movement dependent on the integrity of the tracts involved.

Gordon Holmes believes that the cerebral cortex and forebrain play no important part in nystagmus, as seen clinically. Nystagmus due to acute lesions of the vestibular nerve is generally transient. On the other hand nystagmus due to lesions of the vestibular nuclei and parts closely related to them are the usual cases seen by the neurologist. Nystagmus is present in almost every case of cerebellar tumor, hemorrhage, softening; and was noted in the great majority of gunshot wounds of the cerebellum seen by Holmes in the late war. Fixation nystagmus may persist as long as accurate fixation is sustained. Speaking as an aural surgeon, Sidney Scott holds that nystagmus observed only when the visual axes deviate beyond the binocular field is of no etiological significance. In labyrinthine nystagmus the slow phase is the primary phase, and yet it is customary to designate the direction by the rapid or secondary phase. Nystagmus with diplopia does not receive the attention it merits. A medical man had three severe attacks caused by a plug of cerumen in contact with the drum membrane.

Chronic Progressive Opthalmoplegia Externa. Moebius collected under the name of "Infantile Nuclear Atrophy" a certain number of cases of ophthalmoplegia externa developing in early childhood or of congenital origin.

Other writers, notably Cooper and Bradburne, de-

scribed cases of congenital ophthalmoplegia externa in which there was a definite familial tendency, and in Bradburne's report five generations were affected. Wilbrand and Saenger in 1900, in their monumental work on "Neurology of the Eye," likewise grouped as a clinical entity thirty-two cases of external ophthalmoplegia, separating them from the congenital group and also from those cases due to toxic causes, syphilis or associated with disturbances of the nervous system.

The chief characteristics are, that the onset is gradual and occurs usually in early childhood, rarely in late life, and that the paralysis of the external ocular muscles is bilateral and progressive, frequently coming to a standstill for many years and generally terminating in complete or nearly complete ophthalmoplegia. Ptosis, on one or both sides, is usually the first sign, and as the extra-ocular muscles become involved, diplopia is complained of.

Progress is extremely slow, and thirty to forty years may elapse between the first symptom and the terminal stage. Sight is not involved, the general health is unimpaired and there are no other signs of impairment of the nervous system.

F. Phinzy Calhoun[6] reports the case of a man of 39, whose first symptoms of double vision and ptosis appeared ten years before, and there had been occasional recurrence ever since that time.

What produces this progressive ocular paralysis of the extrinsic muscles is not known. McMullen and Huie explain it by a "lack of inherent vitality" or an abiotrophy of the cells of the nerve nuclei involved, "the time of onset depending on the degree of vitality with which these cells were originally endowed."

As beautiful as this theory sounds, one must admit that it is not altogether satisfactory.

(6) South. M. J., December, 1927.

The Eyelids

Vacciniform Blepharitis Due to an Atypical Herpes Virus. The extent of the domain in which the herpes virus operates as a morbific agent has been the subject of much discussion during the twelve years that have elapsed since Grüter discovered the infectious character of herpetic keratitis. Not only has the clinical concept of herpes been redefined, but such widely dissimilar diseases as epidemic encephalitis and sympathetic ophthalmia have been attributed to the same or to allied organisms. It is of interest, therefore, to see the report of H. B. Andervondt and J. S. Friedenwald[7] of a case exhibiting a pustular eruption on the eyelids. The lesions consisted of vesicles and pustules upward of 3 mm. in diameter; many of the pustules were umbilicated. This picture in no way suggested herpetic infection and except for the history of previous vaccination would have been regarded as a typical example of accidental infection with vaccine virus. (Fig. 20.)

From this case a virus was obtained which when inoculated into the cornea of rabbits produced lesions and symptoms similar to those produced by the herpes virus. Animals thus inoculated were immune to typical symptoms of herpes virus. However, this strain exhibited a difference from other strains of herpes virus in that the intracranial infection of rabbits could be elicited only after a long series of corneal passages.

Pemphigus. A clinical contribution to the study of pemphigus is given by B. Castello[8].

The author's patient, a man of twenty-five years, had undergone a generalized bullous eruption with severe systemic symptoms eight months before. Three months before, during a recurrence of the cutaneous eruption, bullæ had appeared on the face, and on the mucous membranes of the pharynx and conjunctiva. The con-

(7) Bull. Johns Hopkins Hosp., January, 1928.
(8) Ann. di. ottol. e clin. ocul., October, 1927.

junctiva showed intense hyperemia, with cicatricial bands between the lids and bulbar conjunctiva. The corneas were clear, but with small areas of epithelial erosion. Vision was 8/10 and 7/10. In spite of treatment by autoserum, glandular extracts, quinin, arsenic, iodids, and the salicylates, the course of the disease was not modified, and death occurred after about five months. Corneal ulcers occurred, both corneas becoming covered by dense scar tissue, and vision being reduced to light perception.

A review of the histologic findings in reported cases leads to the conclusion that the essential lesion is not the formation of bulbæ, but the inflammatory changes in the subepithelial layers, with resulting scar formation. The shrinking of the fornices is not due to adhesions between raw surfaces deprived of epithelium, but to the contraction of the scar tissue with which the entire thickness of the conjunctiva is replaced. Treatment is without effect on the course of the disease, and must be purely symptomatic, directed to relief of the pain and dryness of the conjunctiva. Exceptional cures which have been reported have probably not concerned true cases of pemphigus but other conditions clinically resembling it.

Trachoma

The Diagnosis of Trachoma. Paul D. Mossman[9] of the Government Service is particularly fitted to speak on this subject. He states that in this country we have several endemic foci of trachoma, the chief one being in the southern mountains of Kentucky, Tennessee, West Virginia, and Virginia. Inasmuch as the states of Missouri and Arkansas were largely settled by persons from Tennessee, Virginia, and Kentucky we have in these states the same type of people, of almost pure Anglo-

(9) Journal-Lancet, Dec. 1, 1927.

Saxon stock, and also afflicted with trachoma. Many counties in these states have no person of foreign birth, and the disease is most prevalent among the inhabitants who are of Anglo-Saxon ancestry. This has not been brought in by any admixture of population from without, and must have been endemic from the time these individuals, chiefly of English and Scotch-Irish blood, settled there.

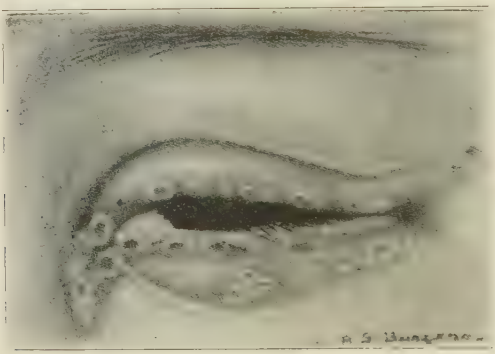

Fig. 20.—Vacciniform blepharitis.

We have in other sections of the country the foci, as we have in Minnesota and doubtless in North Dakota, among individuals who are first or second generation Americans. The immigration law has prohibited people with trachoma entering the country for the last twenty-eight years.

The State of Missouri has a pension law for those who are blind, and practically one-fifth of those pensioners were made blind by trachoma. It is the leading cause of blindness in that state. That is the only state in which we have such accurate figures, but doubtless the same percentage obtains in other sections where trachoma prevails. These pensions for trachoma blind cost the State of Missouri over $265,000.00 annually. These pensioners are so blind that they have only light

perception. A person may see a good deal more than this and still be unable to make his own living and be a liability to his community.

The disease manifests itself in two main forms, the follicular and the papillary, the follicular having the characteristic follicles which you see pictured in the typical cases of trachoma. The papillary type is the acute type in which the conjunctiva of the lid presents an appearance somewhat like a reddened tongue, but there is no pure papillary type of trachoma. With a magnifying lens you will usually see the follicles in the lids, even in the papillary type. After treating these cases for a few days the papillæ subside, and you can see the follicles. This is probably a superadded infection which presents the papillary appearance on the true granular or follicular trachoma.

The process of Nature in dealing with this disease is the formation of fibrous tissue, which cuts off the follicles from the circulation so that they atrophy. The end-result of the untreated case of trachoma is the production of a considerable amount of scar tissue in the lid. Besides the manifestation of the disease in the lid we have the manifestations in the cornea, namely, pannus, corneal opacities, and ulcers. Pannus and opacities of the cornea represent not merely the irritation caused by the scratching of the roughened lid on the cornea, but it is a real trachoma of the cornea.

The same disease which we have in the conjunctiva we have reflected in the cornea. With magnification we can see what resembles trachoma follicles in the cornea. So we have in the cornea pannus, opacity, and breaking down of the cornea into ulcers, which may or may not be infected. Some are perfectly sterile ulcers, while in others we find pneumococci and other infecting organisms.

As to the diagnosis: This is the main point of contention in trachoma, and we have a few points which are fairly well settled. The main stumbling block is

the presence in a good many eyes of folliculosis, or follicular conjunctivitis. In folliculosis we have almost the same thing, except that we have the follicles superimposed on the conjunctiva, while in trachoma the follicles are infiltrated underneath the conjunctiva.

The analogy is drawn between smallpox and chickenpox: in trachoma we have the follicle imbedded underneath the conjunctiva, and in folliculosis we have it resting on the conjunctiva with the thickened base beneath it. The same as in smallpox there is the induration beneath the skin, while in chickenpox it rests on the skin. You will see numbers of follicles that are transparent, with no congestion.

The typical trachoma color is another point of differentiation. It is a sort of mulberry, or raspberry, or reddish-purplish color that is hard to describe, but it occurs in trachoma and not in folliculosis.

Another thing is that because of the absence of the thickened, indurated base in folliculosis you can trace the course of the blood vessels of the lid over the edge of the tarsus and back into the cul-de-sac, but you cannot do that in trachoma. When you evert the lid and press against the part that is constricting the blood vessels the lid will blanch out in folliculosis, while in trachoma this is not true. Later on there is the presence of scar tissue and hypertrophy of the conjunctiva, but it is important to make the diagnosis earlier than this. If we wait for the marked pannus and scar tissue before making the diagnosis we are waiting too long for the best results for the patient. By use of the loupe or the hand-slit lamp beginning pannus may often be discerned long before it is apparent to the naked eye. We should aim to make the diagnosis as early as possible.

We often see a folliculosis with conjunctivitis. The term "follicular conjunctivitis" as applied generally to folliculosis is objected to, for the patient does not usually have follicular conjunctivitis as such. He will have the folliculosis and may get some dust in the eye,

or catch cold, and then develop a conjunctivitis. At such a stage it is impossible to make a definite diagnosis. The thing to do is to mark such a case suspicious and see the patient again in a few weeks, using mild treatment in the meantime instead of calling it trachoma at once and instituting intensive treatment. The way to make a sure diagnosis in these doubtful cases is to consider them doubtful and see the patients repeatedly, at intervals of two or three weeks, and in that way you can clear up the diagnosis. That is a better plan than to consider them trachoma at the start and subject the child to radical treatment when he may not have a trachoma at all.

Dr. Mossman emphasizes these diagnostic points because, as he says, we can all do much good by allaying the fears of anxious parents or teachers in clearing up the diagnosis in negative cases. Make a careful differential diagnosis between folliculosis and trachoma. We should not call everything with bumps on the lids trachoma because there is trachoma in the neighborhood.

There is one thing about states which have a considerable Indian population. Dr. Taliaferro Clark made a survey in Minnesota in 1913 and covered the same ground ten years later. He found that, whereas on his first survey in certain counties one out of eighteen of the school children were of Indian blood, in the second survey one out of six were of Indian blood, and there was much more trachoma in those schools than in 1913. This seemed to indicate that contact between the Indians and the white population as the Indians leave the reservations and take up their residence in the communities was causing a spread of trachoma.

[Some of the finer points of differential diagnosis between trachoma and follicular conjunctivitis are well brought out here, and should be of great benefit to those who are working among these conditions. There should be greater unanimity of opinion between men of equally

good standing, as to the correct diagnosis in these two conditions.—Ed.]

Dudley C. Kalloch[1] who has been doing work in the Near East Relief Clinic, gives a preliminary report on the use of *surgical diathermy in trachoma*. He reports five cases, in all of which there is an apparent cure.

He believes the follicle to be the essential trachoma lesion. The cases of follicular conjunctivitis seen here sometimes develop rather large follicles which differ from the trachoma follicles in appearance and in distribution, being white, having a denser capsule, and containing a liquid; whereas the trachoma follicle is of faintly yellowish tinge, having a more friable capsule (unless of long standing) and containing a gelatinous material.

Early last year he found seven patients showing marked inflammatory changes on the tarsal plate of both upper lids, but whose retrotarsal folds had apparently cleared up under operation. These were put under observation without treatment, and examination a few weeks later, showed a smooth-white cicatrix over the tarsal plates of four of the children and in one eye of the fifth child, whose other eye showed on the tarsal plate of the upper lid a greater degree of inflammation than previously; but it was found in this case and in that of the two remaining children that the follicles had again proliferated in the caruncular area and had spread up over the edge of the tarsal plate. This tendency to spontaneous recovery of the conjunctiva tarsi may profitably be considered by those ophthalmologists advocating wholesale tarsectomies for the relief of trachoma.

The technic of original operation is as follows; the only subsequent modification made is in limiting the area treated:

The patient reclines on the table. Adequate light is provided. Cocain hydrochlorid is applied to the con-

(1) J. A. M. A., Oct. 29, 1927.

junctiva in powdered form with a cotton swab. The spark gap of the diathermy apparatus is set just low enough for the spark to jump the gap of the three controls, the active electrode set at low voltage, the knife lever raised to the second notch. With the first case the indifferent electrode was placed in the patient's hand, but it was found that, by making an electrode out of the metal retractor holding back the lid, an increased activity of the spark was obtained. The lid retractors have two prongs on the end distal to the retracting portion; these are bent to form rings, and the cord clip is attached. The point electrode is made to touch lightly and repeatedly the follicles until they are blanched to their depth. The conjunctiva tarsi is untouched. When the entire retrotarsal fold is given the spark, the point travels lightly across the apparently follicle-free areas also to dry the surface. The point electrode is brought barely in contact with the conjunctiva except where large follicles are encountered, when it is held quite firmly against them. After-treatment consists of mercurochrome-220 soluble aqueous solution, 2 per cent instillation, followed by liquid petrolatum, 1 drop in each eye. This should be continued thrice daily for a week or ten days, although in handling large numbers of patients he has had no untoward results in giving the oil and mercurochrome once daily for three days.

Noguchi's Discovery of the Trachoma Bacillus. Of the 300,000 Indians in the United States, it is estimated that 30,000 have trachoma. The United States Indian Service has attempted to eradicate the disease by an "intensive campaign" but has met with comparatively little success. Recently tarsectomy was heralded as a cure and was performed upon hundreds of children. Many of these were examined last spring, a year or more after the operation, and most of them still had well marked trachoma. There was deformity of the lids in many instances and it was difficult to evert the

lids for the after treatment which is required in nearly all of these cases. Most of the men in Europe and this country who have had the widest experience with trachoma are opposed to tarsectomy as a routine procedure, especially in children who can generally be cured by milder methods and without the deformity so often caused by tarsectomy.

Some months of travel through the Indian reservations, with visits to Indian schools and hospitals and conferences with the physicians in the Indian Service confirmed the opinion that it was impossible to eradicate trachoma by the methods then in vogue.

The most efficient way to have combated the disease would have been to have removed the cause, but the cause of trachoma was unknown. Some had assumed that it was a filterable virus; others attributed it to faulty nutrition. Efforts to find the cause were being made by Prof. Simon of Baltimore and Miss Ida M. Bengston of the United States Public Health Service at Rolla, Missouri. Polk Richards of Ft. Defiance, Arizona, had scarified the conjunctivae of a number of rabbits and then had injected them with material expressed from trachoma follicles and sent them to Prof. Simon. W. H. Wilmer examined these rabbits and reported that they had traumatic conjunctivitis but no trachoma. Miss Bengston had worked for two years but without success. The United States Indian Service was not equipped for bacteriological investigation.

The search for the cause of trachoma had baffled European scientists for many years. Francis I. Proctor*, while discussing the problem with Surgeon General Hugh Cummings, asked him why he had never invited Noguchi to undertake this work and he replied, "I have been trying for ten years to get him to do it, but he has refused."

The next morning Proctor called on Noguchi at the Rockefeller Institute and stated the case as briefly as

(*) Am. J. Surg., September, 1928.

possible. He listened attentively and then inquired, "Are you sure that these Indians have real trachoma?" Upon being assured that he could be shown hundreds of genuine cases, he surprisingly said, without a moment's hesitation, "Then I will go out there and start the work."

Noguchi arrived at Albuquerque, New Mexico, early in May, 1926, bringing with him a number of monkeys and a supply of apparatus which quite filled the room at the hospital reserved for his use. Then followed days of intense activity. He worked from morning until dark, never stopping to rest, frequently going without food, and on one occasion continued working until two o'clock in the morning. Always he was the embodiment of cheerfulness, courtesy, enthusiasm and concentration, an inspiration to all.

On one occasion it was suggested that some blind person might be willing to submit to inoculation for experimental purposes. "No," he said, "you must not speak of such a thing. I would not consider it, but," he added, "if I find the germ and do not succeed with the monkeys, I will try it on my own eyes." This attitude of disregard of self and consideration for others was characteristic of the man.

During the following summer he wrote frequently and always referred to his experiments as "encouraging." In May, 1927, a year after his arrival at Albuquerque, he showed the inoculated monkeys and chimpanzees to DeSchweinitz, Richards, Verhoeff, Derby and Proctor. All agreed that, judged by the clinical appearance, these animals had trachoma. Then followed an examination of sections from the lids of inoculated monkeys, some showing scar tissue formation. Finally came the thrilling moment when these doctors saw for the first time, mobile and clearly outlined in the dark field of the microscope, the bacilli which had been isolated.

Noguchi had isolated a micro-organism from the trachomatous human conjunctiva, had produced a pure

culture of this micro-organism and with it had inoculated the conjunctivae of monkeys, thereby producing a condition having all the appearance of trachoma in the human conjunctiva, and finally from these inoculated monkeys had recovered the micro-organism in pure culture. The requirements of Koch's law had been fulfilled and the cycle was complete.

He reported these results at the New York Academy of Medicine, May 16, 1927, and two days later by special invitation read a paper on the same subject before the Ophthalmological Section of the American Medical Association at its annual meeting in Washington, D. C. His announcement met with a most enthusiastic reception.

Through the summer and early autumn he continued his experiments with inoculations and with blood serum from trachomatous Indians. Full details of these and his other experiments are given in his monograph on trachoma which is about to be published.

Noguchi had long desired to visit Egypt in order to obtain material from trachoma cases there and to compare it with what he had obtained from the American Indians. It is generally assumed that the disease is the same in the two countries but there has been no scientific demonstration of the correctness of this assumption.

He was considering this Egyptian trip in the autumn of 1927 when he was unexpectedly called upon to go to West Africa for work in connection with yellow fever. The work was completed and early in May, 1928, he cabled that he might be able to go to Egypt before returning to New York. A day or two later came the report of his illness and two weeks later the news of his death.

It is difficult to realize how far reaching may be the results of Noguchi's discovery. According to statistics in the possession of the United States Health Service, it is safe to say that of the total population of the world hundreds of thousands, if not millions, have

trachoma. In Europe a trachoma league has been formed, and most governments have recognized the importance of the disease and are endeavoring to control it. But despite the widespread interest in the subject and the great variety of remedies that have been tried, little improvement in the methods of treatment has been made during the last thirty years. Apparently it is necessary to attack the disease from another angle. The results obtained by Noguchi encourage us to believe that progress will be made along the lines upon which he was working and that his discovery is a step, and a most important step, toward the eradication of this scourge which has been causing so much suffering and blindness for hundreds of years.

The Lacrimal Apparatus

Lacrimal Obstruction: Its Nasal Origin and Intranasal Treatment. The exact pathology of lacrimal obstruction is still somewhat obscure. The part played by diseases or abnormalities of the nasal passages and accessory sinuses is considered to be more important than descending infections from the conjunctival sac. According to Kühnt, nasal diseases are responsible for 93.7 per cent of cases of lacrimal obstruction, while a leading textbook on ophthalmology quotes as causes: inflammatory conditions of the nasal mucous membrane; simple catarrhal tuberculosis, and syphilis; ulcers of the nose, tuberculous, syphilitic, and lupoid; and nasal tumors, especially polypi blocking the lower orifice of the nasal duct. Brückner, although he regards nasal causes as uncommon, admits that in the majority of cases diseases of the lacrimal apparatus are nasal in origin. F. Holt Diggle[2] reports the results of an investigation into the nasal condition of 120 cases of

(2) Brit. M. J., Nov. 19, 1927.

lacrimal obstruction observed during the last four years.

Incidence.

The susceptibility of the female sex to lacrimal obstruction is a well known fact, and has never been satisfactorily explained. In the present series 102 cases occurred in females and 18 in males.

The following table giving the age incidence of the disease shows that the greatest number of cases occurred between the ages of 30 and 60, but that of the three decades in this period the numbers of cases were practically equal.

1—10 years	4 cases
10—20 years	5 cases
20—30 years	12 cases
30—40 years	26 cases
40—50 years	34 cases
50—60 years	25 cases
60—70 years	9 cases
over 70 years	3 cases

The oldest was 74 and the youngest 6 years. The shortest duration of symptoms, such as epiphora, was six months; the majority, however, had presented symptoms for two years or more.

Etiology.

Injury. Any injury in the region of the inner canthus producing either a fracture of the infra-orbital margin or of the frontal process of the superior maxilla may mechanically obstruct lacrimal drainage. Similarly a chronic traumatic periostitis in the region of the lacrimal fossa following injury without fracture might be an etiological factor. A definite history of injury was obtained in only 5 cases (4.1 per cent) : 2 developed an abscess over the sac immediately following the injury, with subsequent epiphora, while 3 presented a definite scar, and in all the epiphora began immediately upon receipt of the injury.

Breadth and Width of Nose and Nasal Passages.—Whitnall has shown that the breadth of the lacrimal fossa varies with the shape of the skull, being wider in the brachycephalic and narrower in the dolichocephalic types. The lacrimal fossa is deepest at its base where it joins the nasolacrimal canal, but Gérard has found that the canal is narrowest at the orbital opening, its lower end under the inferior turbinate body being wide and almost funnel-shaped. Moreover, the direction and inclination of the lacrimal passage is dependent upon the configuration of the facial skeleton, being influenced by the breadth of the bridge of the nose and of the nasal aperture, as also by the development of the maxillary sinuses. Testut showed that, seen in profile, the lacrimal fossa and canal slope gently backwards, forming an angle of 15 to 20 degrees with the frontal plane, while, viewed from in front, the fossa slopes outwards towards its lower end and the canal slopes inwards towards its nasal opening, together forming a curve the concavity of which is directed inwards, the summit being near the upper orifice of the canal—that is, the orbital opening. This lateral obliquity of the medial wall of the fossa is more marked in narrower noses. A narrow lacrimal fossa or an acutely curved lacrimal passage may more readily predispose to obstructive symptoms. The breadth of the nose and the width of the nasal passages were found to be distinctly narrow in only 13 cases (10.8 per cent), and in only one of these was the epiphora bilateral. The intranasal prominence of the lacrimal groove was a distinct feature in all these cases. In 16 cases (13.3 per cent) the nose and nasal passages were noted to be unusually wide, and the epiphora was bilateral in 6 cases. In none of the series was the size of the nasal passages dependent upon any deviation of the nasal septum.

Nasal Pressure Deformities and Reflex Neuroses.

Onodi considers that "the ostium of the nasal duct may be wholly or partially occluded by hypertrophy

of the turbinates, by polypoid and papillary degeneration of the anterior end of the inferior turbinate, by foreign bodies, dental cysts, syphilitic and tuberculous lesions, etc." Further, "Changes which take up space or exercise pressure, such as tumors, polypi, the so-called bone cysts, cystic swelling of the middle turbinate, mucous or purulent, spurs and deviations of the nasal septum, will have a like effect." Apart from actual obstruction in the lacrimal passages, Onodi further considers that "there may be a reflex neurosis set up which can evoke from the nose a reflex epiphora." Fischer, quoted by Onodi, describes the cure of a large lacrimal sac the size of a hen's egg, following the resection of the anterior end of the inferior turbinate body.

It is difficult to realize how pressure from an enlarged turbinate bone, deviated septum, etc., can mechanically obstruct a membranous lacrimo-nasal tube, lodged as it is in a body canal. Alterations in the width of the nasal passages following such lesions, which would kink the lacrimal canal, are a rarity. Stimulation of the nasal branches of the trigeminal nerve from nasal pressure deformities may reflexly excite excessive lacrimal secretion with resultant epiphora, but, without some obvious intranasal lesion which would mechanically obstruct the lacrimal passage, permanent distension of the lacrimal sac does not seem to be possible.

Enlarged and Displaced Middle Turbinates.—The middle turbinate was noted to be moderately enlarged in 12 cases (10 per cent), occupying the space between the nasal septum and the outer nasal wall, but with no deflection of the nasal septum. In no instance was there massive cystic enlargement of the turbinate. Six of the series presented a distinctly edematous appearance of the anterior end of the turbinate body. In two cases (not included in the above) the turbinal enlargement was on the side with no epiphora. The anatomical relation of the middle turbinate body to the lacri-

mal fossa is of interest, since Thorsch found that in a series of 79 specimens the middle turbinate in 52 instances lay completely behind the lacrimal groove. In four instances (3.3 per cent) the middle turbinate was displaced outwards without any enlargement and not due to a deviated nasal septum. The peculiarity of these displaced turbinates is that the anterior tip of the lower border was distinctly curved outwards and pressing against the outer wall.

Deviated Nasal Septa.—In only 10 cases (8.3 per cent) was the deflection of the nasal septum severe enough to displace the middle turbinate against the outer wall. The epiphora was in nine instances on the side of the septal deflection, while the tenth presented a bilateral epiphora which was worse on the side of the deflection. In 15 cases the septal deviation was too slight to have any bearing on the etiology, while in 7 cases the septum was deflected towards the side with no epiphora.

Inferior Turbinate Bone.—Considering the anatomical relationship of the inferior turbinate body to the nasal opening of the lacrimal duct it might be thought that lesions of the inferior turbinate would be frequently seen in cases of epiphora. There were, however, only two instances (1.6 per cent) of moderate enlargement in the present series. It is now generally accepted that the site of obstruction in the majority of cases is at the neck of the sac and not at the nasal orifice.

Rhinitis.—Atrophic rhinitis, usually a bilateral disease, was present in 7 patients (5.8 per cent). The epiphora was bilateral in 4 and unilateral in 3 instances. Hypertrophic rhinitis occurred in 6 cases (5 per cent), with bilateral epiphora in 3 patients, all boys, aged 9, 10, and 13 years, with marked hypertrophic rhinitis. Simple catarrhal rhinitis was only seen twice (1.6 per cent).

Accessory Nasal Sinus Disease and Lacrimal Obstruction.

The lacrimal fossa in its upper half is related to the anterior ethmoidal cells, its lower half being related to the middle nasal meatus. According to Whitnall, in the majority of instances (54 per cent) the anterior ethmoidal cells extend as far forwards as the anterior margin of the lacrimal groove and even into the frontal process of the superior maxilla. Less frequently the lacrimo-maxillary suture (32 per cent) or the posterior margin of the lacrimal fossa (14 per cent) forms the anterior boundary of the ethmoidal labyrinth. Pus arising from a suppurative ethmoiditis not infrequently spreads through the lacrimal bone into the lacrimal groove and points externally at the inner canthus. A subacute or chronic inflammatory condition of the anterior ethmoidal cells may similarly extend through the lacrimal bone, producing a local periostitis in the lacrimal groove. The neck of the lacrimal sac may thus be constricted. Moreover, the close anastomosis existing between the venous and lymphatic plexuses of the ethmoidal, as also the maxillary, air sinuses and the mucous lining of the lacrimal drainage apparatus would appear to render the latter susceptible to obstructive lesions in inflammatory states of these sinuses. Ethmoiditis occurred eight times (6.6 per cent) in the present series. There were two cases of closed empyema, four cases of cystic degeneration, and two of non-suppurative ethmoiditis with single polypi. There was no case of extensive suppurative ethmoiditis with multiple nasal polypi, nor was lacrimal obstruction found associated with an empyema of the maxillary sinus.

History of Nasal Disease.—A history of previous nasal trouble was a rarity, either spontaneously stated by the patient or admitted after interrogation. The majority of patients could give no explanation for the onset of

the lacrimal obstruction and denied any knowledge of previous nasal trouble.

Table Showing Incidence of Nasal Diseases
No. of cases examined 120.

Nasal Lesion	Percentage Incidence
Injury	4.1
Breadth of nose and nasal passage—	
Narrow	10.8
Wide	13.3
Enlarged middle turbinate bones (moderate only)	10.0
Misplaced middle turbinates	3.3
Deviated nasal septum	8.3
Enlarged inferior turbinates	1.6
Rhinitis—	
Atrophic	5.8
Hypertrophic	5.0
Simple	1.6
Ethmoiditis—	
Closed empyema	1.6
Cystic	3.3
Non-suppurative with single polypi	1.6

Results of Intranasal Treatment.

To test further the etiological factor of such nasal abnormalities as were discovered, treatment for their relief was undertaken with the following results:

No relief of the epiphora or lacrimal sac distension followed nonoperative treatment for the various types of rhinitis, except that in two cases of marked hypertrophic rhinitis some amelioration of the epiphora resulted from shrinkage of the inferior turbinate body induced by the electric cautery. In both of these cases the epiphora was very pronounced and the improvement would seem to follow the relief of the nasal pressure reflex. The nasal septum was straightened, and where necessary the anterior end of the middle turbinate bone resected, in ten cases, but with no alteration in the epiphora.

No cure of the lacrimal obstruction followed ablation of a cystic ethmoidal labyrinth (four cases).

Complete recovery of the lacrimal obstruction followed drainage of pus in the two cases of closed eth-

moidal empyema. The special interest of these two cases lies in the fact that there was no history of nasal purulent discharge, no free pus in the nose, and, in the first case encountered, the existence of pus was not suspected before operation. In each case the ethmoidal labyrinth had been converted into one large single pus sac.

Intranasal Drainage of the Lacrimal Sac.

This method of treatment (*West's operation*) now so familiar, consists in the establishment of intranasal drainage of the lacrimal sac by removal of its inner nasal wall after thorough exposure through the nose. Intranasal drainage was performed 45 times, with complete recovery in 32 (71.1 per cent), moderate recovery in 5 (11.1 per cent), and failure in 8 cases (17.7 per cent). The term "moderate" is reserved for those cases with slight epiphora when out of doors, but in whom distension of the sac no longer exists; included also under this category are those who, when examined, present some tears at the inner canthus though the patients are quite satisfied. No case is included in the above figures in which operation has been performed less than six months.

J. S. Fraser, who has had a large experience of this operation, gives 73.4 per cent cures, and this is the experience of all those who have essayed the procedure on any large scale. The operation should not be attempted in the presence of acute dacryocystitis. External incision and drainage must first be established and the inflammatory condition allowed to settle down. A slit canaliculus does not preclude a perfect result.

It would appear from the present investigation that the incidence of nasal abnormalities, deformities, and diseases, in cases of established lacrimal obstruction, is a rarity. The failure in relieving the lacrimal obstruction following the rectification of such nasal lesions as were found, with the exception of suppurative eth-

moiditis, which is in itself rare, seems to preclude them as etiological factors in lacrimal obstruction. The absence of a history of nasal trouble in the majority of cases, as also the rarity of the incidence of nasal disease, would seem to render the nasal origin of lacrimal obstruction "non-proven." That there is a nasal cause would seem to be undoubted, but its exact pathology and incidence needs still further investigation.

Surgical Relief of Chronic Dacryocystitis and Epiphora. The Dupuy-Dutemps and Bourguet technic: A direct anastomosis of the tear sac with nasal mucous membrane. In the tear sac surgery of today there are two distinct objectives: the operation must relieve and prevent the recurrence of the infection, and it must banish for all time that ever present and most annoyiny concomitant disturbance, epiphora. If an operation on the lacrimal drainage apparatus is not devised to accomplish this twofold purpose, it should not be given any place in present-day ophthalmic surgery.

But why the emphasis on ophthalmic surgery? As a matter of fact, though strange, most of the progressive work along this line has been done by the rhinologist, and not by the ophthalmic surgeon, until Dupuy-Dutemps presented to the Ophthalmological Society of Paris in June, 1920, a description of his technic, which consists of a direct anastomosis of the lacrimal sac with nasal mucous membrane.

Simple extirpation of the sac as a remedial measure in cases of chronic dacryocystitis is obsolete. As a surgical procedure it is not adequate; its end result is incomplete. It removes the infection, pus, phlegmon, but does not correct (only in rarely exceptional cases) that most troublesome feature which is all important to the patient, the constant overflow of tears.

Instead of extirpation of the sac there are, at present, three outstanding methods, each of which is designed to relieve, not only the inflammation, but also the epiphora. These are the West operation, the Toti operation, im-

proved by the Mosher modification, and the Dupuy-Dutemps and Bourguet operation.

The West operation is essentially an intranasal procedure. The Toti and Mosher-Toti operations present a combined intranasal and extranasal technic, while the approach in the Dupuy-Dutemps-Bourguet operation is entirely from the outside. The first two methods have met with a high degree of success. The statistics of the last would indicate an unusually satisfactory record of good results. When this operation becomes better known, it undoubtedly will make a very strong appeal to, and become very popular with the ophthalmic surgeons for three very good reasons: it is (1) the only operation which preserves intact the lacrimal sac; (2) the only operation which provides a definite means of maintaining the patency of the newly made drainage canal; (3) the only operation which provides against the formation of granulations which defeat an otherwise successful technic. More, the very high degree of success in clearing up both infection and epiphora will assuredly command attention.

J. J. Corbett† reports his impressions after witnessing Dupuy-Dutemps perform his operation on several occasions both at the St. Louis Hospital and the Rothschild Foundation in Paris during the summer of 1925. He operated under local anesthesia, and had two well trained assistants in each institution. The average time to complete the operation was 45 minutes, very evidently aided largely by the ideal teamwork.

He injected 2 c. c. of 2 per cent novocain solution in adrenalin chlorid along the line of incision; saturated a cotton plug with a 10 per cent solution of cocain in adrenalin (1-1000) and placed it in the middle meatus of the nose near the anterior tip of the middle turbinate in order to produce an anesthesia and ischemia of the nasal mucous membrane. The plug remained in this position until the nasal mucous membrane was exposed by the removal of the lacrimal crest. This anesthesia

(†) M. J. & Record, Aug. 15, 1928.

was sufficient to last throughout the operation, and Dupuy-Dutemps stated in his paper of September, 1922, that he had operated upon a child thirteen years of age using the same anesthesia without any difficulty whatsoever.

Illumination of the field of operation is an important factor, and Dupuy-Dutemps uses a concave illuminated head mirror, which throws sufficient light. He considers this type of illumination indispensable.

The skin incision is that commonly used in all external sac operations, starting about ½ cm. above the internal palpebral ligament, passing down over its bony insertion (about 5 mm. to the inside of the inner canthus) in a line parallel to the lacrimal crest and terminating at a point opposite the entrance of the nasolacrimal canal.

The internal palpebral ligament is cut, the superficial fascia, muscle, and deep fascia parted, the sac exposed and reflected outward as it is lifted out of its bony groove. The sac is retained in this position by means of a retractor, while a similar retractor holds the structures on the opposite side of the wound well over toward the median line. The retractors are held by one assistant while the other assistant works in the field with the operator.

The next step is the complete removal of the anterior lacrimal crest by means of a chisel. When the nasal mucous membrane is exposed, the bony opening is enlarged with a Citelli forceps making an oval shaped window with the long axis (10 to 12 mm.) in the vertical plane; the transverse diameter varies from 8 to 10 mm.

At this point a longitudinal incision is made in the wall of the sac; the pus or mucus, if present, is removed, and the inner lining of the sac is swabbed with tincture of iodin. The nasal plug is then removed. A vertical incision is made in the nasal mucous membrane, equal in length, and directly opposite the sac

incision. Three sutures of 000 catgut are passed through the posterior tip of the nasal mucous membrane with the help of a small semicircular Deschamps needle. These three sutures are held taut while a cut 2 mm. long is made at a right angle to the upper and lower ends of the vertical incision. This gives a flap which facilitates approximation to the posterior lip of the sac. These three sutures are now drawn through the posterior lip of the sac incision by means of a small Reverdin needle, tied and cut close. Thus is formed the posterior wall of the new lacrimal drainage canal.

After the same fashion three more 000 catgut sutures are passed through the anterior lip of the nasal mucous membrane with the Deschamps needle, held taut while the right angle cuts (similar to those in the posterior lip) are made. These sutures are now drawn through the anterior border of the sac, and, in addition, through the periosteum and overlying soft tissues. The sutures are then carefully tied. It is this last little feature of the Dupuy-Dutemps technic, (the suspending of the anterior wall of the canal to the overlying tissue) which aids in maintaining the patency of the new lacrimal canal.

Three silk sutures close the skin incision. An ordinary eye bandage is applied but there is no intranasal dressing. Sutures are removed on the fifth day, and on the eighth day the bandage is discontinued.

Dupuy-Dutemps and Bourguet reported operations in 150 cases. They were able to check up on 115 patients who returned for observation with the following results: Complete failure (without return of dacryocystitis), 4; partial success, 7; complete cure, 104.

In the classification of "complete failure" they included those cases in which there was total obliteration of the newly made orifice with the epiphora persisting but no suppuration. In other words, the cases included in this classification present results similar to those following extirpation of the sac.

"Partial success" refers to those cases in which it can be demonstrated by an injection from a syringe that there is really an anatomical communication, but one which is not physiologically capable of the normal evacuation of tears. The epiphora persists, and a colored solution dropped into the conjunctival sac does not drain into the nose.

"Complete cure" is applied only to those cases in which there is no longer any signs of epiphora, and in which the physiological permeability of the lacrimonasal communication can be demonstrated by the spontaneous passage into the nose of a colored solution which has been instilled into the conjunctival sac. These requirements come pretty close to measuring up to the normal drainage of the lacrimal secretions.

In June, 1925, Dupuy-Dutemps stated that, to date, he had done about 500 operations with total relief in 97 per cent of the cases. This is an unusually high percentage of cure, higher, in fact, than that which has been accomplished by any other operation performed for this purpose.

Since September, 1925, it has been possible for the writer to bring to the operating table only 31 cases of chronic dacryocystitis in patients whose histories have varied from 1 to 15 years' duration. Two of these patients had double chronic dacryocystitis, making the total number of operative cases 33. These cases were done under ether and with the profuse bleeding which always accompanies this kind of anesthesia. For illumination, the Cameron headlight was used, otherwise, the technic above described was followed as closely as possible.

All of these cases were followed for one month at the end of which time all could be classified as "complete cure" except 3 cases. Of these 3, 1 was a "complete failure," and the other 2 would come under the classification of "partial success."

Dupuy-Dutemps and Bourget reported the results of their operation on several occasions between June, 1920, and May, 1924; and in addition at a Conference in Barcelona in February, 1925, gave statistics on 420 cases.

As far as can be ascertained, the writer is giving the first description of their technic with a report of a series of cases which has been published in English. Personal observation of these few cases, together with the very high percentage of success reported by Dupuy-Dutemps and Bourget leads to the belief that here is a method for relief of chronic dacryocystitis and its attendant epiphora well worth while copying, developing and perfecting by ophthalmic surgeons.

Chronic Dacryocystitis. Two cases of unusual interest are reported by W. L. Simpson‡.

Case 1. Dick S., aged 4, came with the complaint of redness and swelling of lachrimal sac region with tears over cheek, practically all his life. The skin became quite red and swollen at times. When the patient was first seen the right eye, lids, and conjunctiva, were red and swollen. The skin was especially red in the lachrimal sac region. Pus came from the lower canaliculus on pressure over this region. The tonsils and adenoids were large. The lachrimal sac, adenoids and tonsils were removed. The purulent discharge continued for more than one year, when the lachrimal sac region was again opened. The usual incision for lachrimal sac operation was made. Pus was pressed from both upper and lower canaliculi. A No. 3 probe passed into the lachrimal sac region, which contained a granular mass in which there seemed to be a small cavity, thought to be another portion of the lachrimal sac. In removing this granular mass there was uncovered just posteriorly to the lachrimal fossa an opening in the bone extending directly into the anterior ethmoid cells. This opening was enlarged and the anterior ethmoid cells were found

(‡) J. Tennessee M. A., August, 1928.

entirely filled with thickened membrane which was granular in appearance. Two or three posterior ethmoid cells were large and were not entirely filled with mucous membrane but contained a moderate amount of pus. The entire ethmoid cavity was thoroughly cleansed of mucous membrane, leaving the entire middle turbinate. The cavity was packed with iodoform gauze; the wound closed with dermal.

Case 2. Capt. A., came with a history of swelling and redness of lachrimal sac region over a period of several years. He had a purulent discharge from the eye, with a foul odor, for the last year. The pus came from the canaliculi on pressure over the sac. A lachrimal sac exenteration was done one year ago, but since the operation the lachrimal sac region has been red and pus has continued coming from the lachrimal canaliculi and from a fistula in the skin. An *x*-ray showed all sinuses increased in density and especially those of the right side. On January 20, 1928, the lachrimal sac region was again opened. The fistula from it was dissected from the surrounding tissue. The fistula led down toward the posterior lachrimal fossa leading into the anterior ethmoids. Granulations were protruding from the ethmoids into the lachrimal sac region. The ethmoid, sphenoid and frontal sinuses were filled with thick polypoid mucous membrane and muco-pus which were removed.

These two cases are entirely different from the usual lachrimal sac or ethmoid cases. There is very little if anything exactly similar to these cases in the literature. Many cases acute and chronic of ethmoiditis involve the orbit but ethmoid infection involving the lachrimal sac drainage through the canaculi or through the skin of the lachrimal region before or after a lachrimal sac operation are not common. It might be said that probably at the time of the first operation on the lachrimal sac that an injury to the ethmoid capsule was brought

about, but at neither of these operations was anything of the kind noticed.

Both of these cases are entirely relieved from all symptoms of the lachrimal sac region.

Lymphoma of the Conjunctiva. P. Speciale[3] reports a new case of this condition, which, with several cases previously published, demonstrates the rapid effect of the *x*-ray in clearing up these lesions. The tumor arose from the lower cul-de-sac, and involved most of the bulbar conjunctiva, the cornea being surrounded by a reddish granulomatous tissue. The iris was congested, and the lower chamber angle contained exudate. Examination of the blood showed nothing abnormal, and there were no enlarged lymph nodes to be made out elsewhere in the body. Sections of a piece of the tumor removed for biopsy showed it to be composed chiefly of small lymphocytes, with some plasma cells. A month after one *x*-ray treatment, a new growth had completely disappeared, the exudate had been absorbed from the chamber, and vision had improved markedly. Sections of a nodule removed eight days after the exposure showed the lymphoid tissue undergoing regression, small foci being surrounded by new-formed connective tissue.

The Cornea and the Sclera

Keratoconus. This condition is so infrequently encountered by the average ophthalmologist, the following resumé by E. C. Ellett and R. O. Rychener[4] is of special interest. Seven cases are reported by these observers.

Keratoconus is a non-inflammatory affection of the eye, whereby the cornea becomes thinned centrally and bulges forward in a hyperbolic curvature to assume

(3) Ann. di. ottal. e clin. ocul., October, 1927.
(4) J. Tennessee M. A., February, 1928.

the form of a cone. It is usually bilateral and has a tendency to be progressive, resulting in a marked diminution of vision.

The etiology is purely theoretical. Parsons cites various possibilities, each of which has its group of authoritative adherents, namely: (a) Increased intra-ocular pressure; (b) malnutrition of the cornea; (c) diminution in resistance of the cornea; (d) inherent weakness and deficient firmness and thickness of the cornea; (e) defective embryological development and growth of the center of the lens; (f) chronic disease of Descemet's membrane and the endothelium; (g) relatively greater extra-ocular than intra-ocular pressure. Von Hippel believes it to be due to an endocrine disturbance, citing cases associated with a diminished activity of the thyroid, thymus and adrenals. Collins and Mayou consider it as a development defect resulting in a failure of the post-natal toughening of the corneal tissue.

The increase of intra-ocular pressure may not be absolute, i. e., it may not be demonstrably above the theoretical normal, either when tested by the fingers or by a tonometer; but it is relatively high, that is, it is higher than the tissues of that eye can stand. The altered shape of the cornea might introduce an element of doubt as to the accuracy of a tonometric reading.

Wolz after extensive search through the literature, believes keratoconus to be inheritable, citing at least two instances in each group, where this affection was found in (a) mother and daughter, (b) father and son, (c) several brothers, (d) sisters, and (e) cousins. He also discovered a family in which keratoconus and congenital cataract were continued through three generations; in some cases the two anomalies combined in the same individual and in others were isolated.

The pathology of the disease presents in general a thinning of the central zone with lacerations in Desce-

met's membrane. Fleischer's case showed a thickness of the cornea which was centrally only one-half that at the periphery, while the substantia propria was only one-third its normal. At the apex the parenchymal cell nuclei presented a very irregular arrangement and Bowman's membrane was absent at places where nuclear multiplication under the membrane was especially marked.

The opacities at the apex are the result partly of lacerations through Descemet's membrane with invasion of aqueous into the substantia propria and partly of mechanical injuries to which the superficial layers of the cornea are exposed at the point of greatest prominence. With the slit lamp one can note besides the diffuse opacity of the propria and the ruptures in Descemet's membrane parallel grey lines which are usually vertical. These are of undetermined origin.

The diagnosis is easy in the late cases where the typical dewdrop formation in the apex of the cone is present or where central corneal opacity has already occurred. It may be just as easily overlooked in early cases because of corneal transparency, but the retinoscope and ophthalmometer are invaluable aids in its detection. Killick thinks Placedo's disk helps most in the early cases, while Weeks places most reliance on the ophthalmometer, especially that like the Javal model.

The prognosis cannot definitely be foretold, for keratoconus acts differently in various individuals, sometimes remaining stationary for years, sometimes reaching the highest pitch in the progress of the disease. Indeed, it often acts quite differently in the two eyes of the same individual. But the sufferer with this affliction has a rather miserable outlook, for even though good vision is maintained, the individual is rarely free from symptoms of visual discomfort.

The treatment consists either in the use of miotics and pressure bandages combined with careful refraction or in some form of operative interference. Killick and

others think that treatment is almost always a question of surgical interference, while Sattler believes surgery has a limited application in this condition.

Various efforts have been made to check an inexorable advance of a deformed central area of the cornea by converting this area into an opaque scar or a series of cicatrical lines. Chief of these adherents is Herman Knapp, who reports excellent results with the galvanocautery, which he uses at a dull red heat to cauterize the apex of the cone to the point of perforation. Others, including Parker, do only deep iridectomy, which has the two-fold advantage of supplying an artificial pupil, and facilitating drainage and lowering the tension which is too high for the attenuated yielding cornea of keratoconus.

Numerous excision operations have been devised based on the idea of causing cicatrization and flattening of the cornea. Fox makes a horizontal incision through the cornea, 3 m.m. above the horizontal meridian, performs an iridectomy and then cuts a semilunar strip from the lower corneal lip and brings the edges of the wound together. Alonzo makes a horizontal incision through the apex of the cone, trims off the upper and lower lips of the incision and closes with fine Kalt sutures. He covers the whole with a conjunctival flap for seven to ten days.

Tiffany advocates a corneoscleral trephine to attain the same result, placing his wound at the point of maximum pull of one of the recti muscles. He sees no disadvantage in successively placing other trephine openings before other recti muscles, in case a single operation does not produce the desired result.

The Lagrange operation consists in a corneoscleral incision terminating under a conjunctival flap. An elliptical piece is then excised from the scleral lip of the wound, an iridectomy performed and the whole covered by conjunctiva. It would seem that this operation might not be attended by such untoward events

as may be expected of those confined to the cornea, and is advocated in preference to the Fox operation by the Greens of San Francisco.

Lagrange has recently reported eleven cases of keratoconus treated by "sclerecto-iridectomy," and re-examined after intervals varying from one to fifteen years. The visual results were all remarkably good and their lasting character affords evidence of the value of this procedure.

Blue Sclerotics. Duggan and Nanavati[5] have traced the family tree, in which a maternal parent was affected. There were three daughters and one slightly affected son. In the third generation there were five males and six females affected, all children of the three affected daughters. The slightly affected son had three unaffected male children. The cases were bilateral, and no evidence of fragilitas ossium, deafness, or syphilis could be obtained. Only one had an error of refraction, myopia. Four case reports of members of the family are given. There was a fifth case report of a patient with blue sclerotics and a blue discoloration of the face in no way connected with the hereditary group.

Specific Treatment of Pneumococcic Ulcer of the Cornea. The discovery by Uhthoff and Axenfeld in 1896 and 1897 that serpiginous ulcers of the cornea with hypopyon are practically always due to the pneumococcus, and that of Morgenroth and Levy that the pneumococci are exquisitely sensitive to ethylhydrocuprein hydrochlorid (numoquin hydrochlorid), has inaugurated in the majority of cases a specific for one of the most destructive of corneal infections, and in practically all cases without a mixed infection. Where the associated organism is demonstrable, auxiliary measures will maintain the specificity of the treatment. All cases of corneal ulcer from whatever origin, should receive the immediate supervision of the ophthalmologist,

(5) Brit. J. Ophth., September, 1927.

and Max R. Dinkelspiel[6] believes that the timely and proper application of ethylhydrocuprein hydrochlorid in selected cases may preserve vision which otherwise becomes irrevocably destroyed.

Heretofore, in grave and malignant cases, the actual cautery, paracentesis of the cornea, and serum therapy (Roemer) were the last active resorts. Roemer's indefatigable work, while very promising in animals, unfortunately did not survive the ordeal of clinical experimentation. This was due first to the difficulty of antibodies penetrating the corneal tissue, and secondly to the difference in immunity reaction of the various types of pneumococci.

The actual cautery has offered distinct advantages, but also some disadvantages. It has often limited as well as increased tissue destruction. It requires an unusually experienced hand. It will by no means destroy all the pneumococci, neither can it reach them all; and in the case of impending perforation may do considerable damage. Applied early it often has done much good, but unfortunately the cases are often not seen sufficiently early. Where the actual cautery and proper electrodes are not available, the difficulty of application and hazard are enormously increased by improvised apparatus. Milk and kindred injections are still in the experimental stage. We could safely disregard the usual array of chemical cauterants in a typical serpiginous ulcer, in favor of the actual cautery before the observations with numoquin hydrochlorid. Valuable time will be saved by prompt specific therapy directed to the ulcer, and the frequent concomitant disinfection of the lacrimal sac, or in pronounced dacryocystitis, extirpation.

Knowing that spontaneous resolution of the cornea is rare in serpiginous ulcer, and that varying degrees to total loss of vision are the inevitable results, ophthalmologists have long hoped for a bactericidal agent

(6) M. J. & Recrd, Feb. 1, 1928.

that would destroy the pneumococci locally, without affecting the integrity of the healthy corneal tissue and infrequent occurrence with measures heretofore employed.

This was realized in ethylhydrocuprein hydrochlorid, and there remains but the therapeutic refinement from experience to perfect the treatment. On the other hand the fact must not be ignored that very small pneumococci ulcers of the cornea may occur with a slight hypopyon, also that in a clinically grave serpiginous ulcer in from 10 to 20 per cent of cases (Wessely) a mixed infection will occur (diplobacilli and occasionally streptococci). Zinc salts may at times be of advantage where the diplobacilli are present.

The author's method of using ethylhydrocuprein hydrochlorid is as follows:

1. As a prophylactic measure he has employed a 1 per cent solution in all cases of corneal injury, especially from foreign bodies, which in this region mostly comprise coal and rock from the mines, and emery from industrial establishments. As a prophylactic measure, it was always used as an instillation of one or two drops in the conjunctival sac, and only applied directly to the cornea if any ulceration was present.

2. Topical applications employed wherever there was a beginning ulceration surrounding a foreign body which may have been imbedded for several days, or any perceptible after the removal of the foreign body; and of course any subsequent ulceration.

3. In the treatment of serpiginous ulcers, a fresh solution is immediately prepared. He has had no experience with old solutions, but accepted the observations of practically all observers that the solutions begin to lose their therapeutic value in from two to three weeks.

4. The strength of the solution varies from ½ to 1 per cent for conjunctival instillations to 2 to 3 per cent

solution for topical applications, generally 2 per cent, rarely 3 per cent.

5. All solutions are sterilized and do not lose their therapeutic value therefrom.

6. In the case of topical applications, swabs are used on wooden applicators, the tips being shaped according to the size of the area to be treated. The cotton should be wound around the applicator so that no protruding fibres carry the drug to any undesired area. The eye is invariably anesthetized by a 2 per cent solution of cocain, two instillations being made five minutes apart. The floor of the ulcer is then very gently swabbed with a saturated solution of boric acid. The numoquin hydrochlorid solution is applied with a gentle but continuous contact to the ulcer for one minute, and the eye irrigated with a ½ per cent solution of the same drug. A drop of atropin solution, 4 gr. to the ounce, is instilled, and the eye bandaged for 24 hours.

7. In all cases thus treated during the past nine months, there has not been a single case that did not proceed to complete resolution. In all the cases of serpiginous ulcer of the cornea, the propagation of the ulcer was arrested in all cases with a limited macula remaining.

8. In the case of a mild dacryocystitis the canaliculus should be slit and the lacrimal duct rendered patulous by rapid dilatation, and irrigated with ½ per cent ethylhydrocuprein hydrochlorid solution; in more marked cases incision and evacuation, while in advanced cases the sac should be extirpated.

9. Before all intra-ocular operations, a drop of ¼ per cent ethylhydrocuprein hydrochlorid solution should be instilled.

10. In addition to the valuable evidence *in vitro,* there appears to be no question but that as A. Maitland Ramsay stated in 1915, "That it is possible to kill the microbe in the substance of the cornea without injury to the cornea itself."

11. In cases which are seen late, especially with iritis and posterior synechiæ as complications, ethyl morphin hydrochlorid (dionin) should be promply employed. In mild cases of iritis a 2 per cent solution is instilled every 2 or 3 hours for its lymphagogue effect.

Van der Straeten[7] reports four cases of *corneal disease,* in all of which there were trophic disturbances with corneal anesthesia, and each of which was promptly relieved by removal of molar or bicuspid teeth which carried apical abscesses or cysts. In each instance the dental lesion had caused no pain and was only revealed by radiography.

Blastomycosis of Eye and Face Secondary to Lung Infection. Fungus involvement of the lungs, according to the statistics of a medical officer, is of frequent occurrence in certain localities of England. A case is reported by A. S. Ferguson[8] in which the eye and face conditions are definitely secondary to the lung infection. The patient, 58 years of age, was ill and emaciated. There was slight sclero-keratitis with accompanying ciliary infection of the left eye. Within a week the limbæ conjunctiva and epidural tissue showed a raised violaceous thickening, and a ring of large granulomata formed a corona around the cornea. At the same time a large beefy-looking growth appeared on the right cheek. This was excised by a consulting surgeon, but by the time the stitches were ready for removal there was a recurrence spreading up to the right lower lid, and another growth appeared on the nose, over the left ala and tip. A tentative diagnosis of tubercle was made, in spite of the rapidity of invasion, and the report of a well-known pathologist to whom a section of the growth had been sent seemed to confirm this. Examination of the sputum showed the infection to be monilia, and the method of infection of the skin was undoubtedly due to the use of handkerchiefs infected from sputum.

(7) Bull. Soc. Belge d'Opht., April, 1927.
(8) Brit. M. J., March 17, 1928.

The treatment recommended was increasing doses of potassium iodid up to 30 grains thrice daily, and weekly increasing doses of monilia vaccine, the parts to be painted with a solution of 0.5 per cent each of brilliant green and crystal violet to combat sepsis, and the patient advised to use paper handkerchiefs. Skin infection with monilia is known, and is less frequent than moniliasis of lungs, no case of double infection of lung and skin having been recorded, according to the literature available, but owing to the fact that monilia skin infections are usually on the face, it is quite possible that these infections may be secondary to a lung infection. The frequency of monilia of the lung is as common as tuberculosis of the lungs, and most of these latter suffer from the double infection. *In vitro* it has been found that there is a symbiotic action between tubercle and monilia. Tubercle grows readily in an alkaline medium, while monilia require an acid medium. All cases of true double infection do best by having monilia treated first, and then proceeding with tubercle vaccine.

Under this treatment the granulomata and ugly violaceous thickening disappeared from the eye, the growths on cheek and nose vanished, and the patient increased nine pounds in weight in five weeks.

The Iris

The Pupillary Findings in General Medical and Surgical Cases. Anomalies in the regularity, the equality and light reaction of the pupils are frequently noted in the patients of a general surgical and medical case, who may come to the physician for a herniotomy or a bronchitis, but little if any significance is attached to them. Certain of these anomalies are established stigmata of neuropathology, especially of neuro-syphilis, but many seemed to have no relationship to such. Be-

cause of what seemed to be a frequent occurrence of such an unexplained pupillary pathological condition, an attempt was made by William C. Menninger[9] to determine the relative frequency of their occurrence and the relative frequency of a definite diagnostic indication.

Using care to exclude primarily neurological and ophthalmological cases, the pupils were specially examined in the course of one thousand routine examinations on the second division medical and surgical wards of Bellevue Hospital. Special inquiry was made regarding a history of eye disease or injury and the presence of subjective ocular symptoms (lacrimation, blurring, photophobia, headache, and other conditions). Note was made of a history of syphilis, antisyphilitic treatment, objective signs of syphilis, and the blood Wassermann test in every case. The spinal fluid Wassermann test was made as often as possible, but although extremely desirable for such a study, in the majority of cases a lumbar puncture could not be done. Certain exclusions were made on the basis of age, because it is generally recognized that senility affects the pupillary reactions; no cases over sixty years of age were included and of the cases between forty and sixty years old, only those which presented quite marked anomalies were included. This series includes, moreover, no patients under fifteen years of age and only a few under twenty.

An analysis of the anomalies found in the routine examination of this one thousand cases is presented in the following table:

Irregularity of contour	133	13.3
Inequality	75	7.5
Sluggish reaction to light	106	10.6
No reaction to light	28	2.8
Other anomalies	4	.4
Total number of cases showing some anomaly	176	17.6

Comparing these findings with previous reports in

(9) M. J. & Record, April 18, 1928.

the literature, it appears that in a series of 14,392 general cases, Uhthoff found only 1.8 per cent to show abnormalities; Iwanoff 9 per cent of 134 cases; Mautoux 9 per cent of 185 cases; Dufour 4.5 per cent of 173 cases. However, as all of these writers were interested in fixation or near fixation of the pupils, their figures do not include all the anomalies included in the present study. The importance of these other anomalies is emphasized in all neurological textbooks, and is obvious from a consideration of many neurological case reports, yet the precise data concerning pupillary pathology other than marked anomalies is rarely mentioned, or considered sufficiently in the diagnostic examination of routine medical cases. The statistical data just cited indicates the error of this omission. It remains to analyze the anomalies specifically as to type, degree, and relationship to syphilis.

Irregularity of the pupil.—Of the 176 cases showing some pupil anomaly, the contour status was as shown in the following table:

Regular	43 cases
Slightly irregular	52 cases
Moderately irregular	62 cases
Extremely irregular	19 cases

Care was used to eliminate those cases of a known history of iritis or other form of eye disease and injury. Eliminating such cases as far as possible, the 133 cases in the total series of one thousand studied, represented changes in contour due to other causes than local disease or injury.

The significance of this irregularity is difficult to evaluate, particularly in the case of moderately irregular pupils. A careful analysis of the nineteen cases showing marked irregularity, however, shows that five had positive serum Wassermann tests and five others gave a definite history of syphilitic infection.

Wilbrand and Saenger hold the opinion that anisocoria often precedes fixation in neurosyphilis and is

with the same diagnostic and prognostic significance. They quote Piltz who made a detailed investigation of the literature on irregularities of the pupils in organic nervous disease and some experimental work on animals. He concludes that tabes, paresis, and cerebral syphilis often present anomalies in pupil contour and seldom do such occur in other nervous and mental diseases; only rarely do they occur in healthy persons. These irregularities often occur earlier than the Argyll-Robertson phenomenon, so they are of important significance. Lewis states that irregularity in contour may be congenital and quotes Piltz that in normal infants at birth, the contour is not always regular but soon becomes so. However, in the adult, Lewis believes it to be rarely present in health and nearly always the advance of premonitory symptom of grave disease of the central nervous system such as tabes, paresis, or multiple sclerosis.

The present study does not support the view that pupil irregularities usually signify syphilis. Only slightly more than 50 per cent of the most marked cases could be demonstrated as syphilitic, and a very small percentage of the cases showing moderate and slight irregularities were syphilitic.

Inequality of the pupils.—In the 176 cases showing pupillary anomalies, seventy-five were unequal or 7.5 per cent of the total one thousand cases examined. The frequency of inequality in this series is lower than reported by most other observers.

It is a pertinent question as to how many of these cases of unequal pupils were explicable on the bases of the most common cause of pupillary pathology, namely neurosyphilis. In the instances showing a marked inequality (23 cases) only 5 had positive serum Wassermann tests. The remaining instances (52 cases) which showed only a moderate inequality, included 15 cases definitely syphilitic (11 with positive Wassermann tests and 4 with positive histories but negative serology).

Light reflex.—The reaction to direct light stimulation was as follows:

Normal reaction	42 cases
Moderate impairment of reaction	63 cases
Marked impairment of reaction	43 cases
No reaction	28 cases

An attempt is made in the above groupings to include both impairment in the speed of the reaction as well as in the distance through which the reaction takes place. Both were considered in determining the classification of a case. These figures include those cases which may have shown the phenomenon in one or in both eyes.

In the group of cases in which the pupil was fixed to light, there were sixteen instances in which there was either a positive Wassermann test or a definite history of syphilis. In twelve cases, the pupils responded to accommodation but not to light—the Argyll-Robertson phenomenon, and other than this sign, there was no apparent objective proof of neurosyphilis. There are three explanations: (1) this sign may be only remains of a healed or arrested syphilis; (2) it may be the isolated sign of a localized neurosyphilis; (3) or it may be due to an organic central nervous system disease other than syphilis.

1. It is recognized that in arrested cases of neurosyphilis, showing entirely negative serology, the Argyll-Robertson pupil may be present. This then represents the residual damage of an inactive or cured neurosyphilis in which at some previous time the Wassermann test was positive and has become negative. It may be the only remaining scar of such a process.

2. The occurrence of the fixed pupil to light stimulation as an isolated sign of neurosyphilis has long been recognized. Meyer found it once in 71 cases in which there were no other objective anomalies of the central nervous system. Buttino records it once in 70 cases, and Mautoux once in 101 cases. Other such isolated

cases are reported by Fleck, Dufour, Babinski and Charpentier, Mass, etc. Nonne concludes from many years of study that an isolated pupil fixation may remain stationary for years or it may be associated with a rapidly progressive neurosyphilis, but in any case it is of prognostic importance and entire dependence should not be placed on a four plus Wassermann reaction. Wilbrand and Saenger call attention to the occurrence of isolated pupil fixation and when occurring with negative serologic findings, regard it as a favorable prognostic sign. Wullenweber concluding from the study of 28 cases regards these instances with a more favorable prognosis, and Thaysen bases his therapy in such cases on the changes in the pupils, they being the only objective anomaly. The last named worker maintains that cases over fifty-five years of age have a good prognosis despite the blood Wassermann test, but under this age treatment is advisable.

3. Neurological conditions other than syphilis, in which the Argyll-Robertson pupil occurs, are numerous; it is recorded frequently in disseminated sclerosis, cerebral tumors, syringomyelia or syringobulbia, less commonly in chronic alcoholism, diabetes mellitus, chronic hypertrophic interstitial neuritis, progressive muscular atrophy, and traumatic lesions (Wilson). It is also recorded in epidemic encephalitis, meningitis, and in various poisonings.

A unilateral Argyll-Robertson pupil was present in seven cases, three of which were definitely syphilitic. The remaining four failed to show any other sign of syphilis.

The interpretation of the pupillary reactions to light is also difficult. Sixty-four per cent of the cases showing complete light fixation were definitely syphilitic without taking into account those cases in which the blood serum Wassermann test was negative and the spinal fluid may have been positive. However, even of more interest are remaining cases in which the blood

Wassermann was negative and there were no other objective findings of syphilis. These cases included the following general medical or surgical diagnosis: two fractured femurs, two abscesses, pancreatitis, cholecystitis, carcinoma of the stomach, lobar pneumonia, empyema, rheumatic cardiac, chronic alcoholism and diabetes mellitus. Cases of Argyll-Robertson pupils have been noted in both the last two systemic conditions although the explanation as to the cause is not clear. The fact that these may represent a healed syphilis cannot be ruled out except the history in each case was negative for syphilis and there were no other objective signs of syphilis on physical examination.

In the cases showing normal light reaction (42 cases) the Wassermann was negative in every case. This fact supported by the relatively high percentage of positive Wassermann tests in the completely fixed group, would suggest that the light reaction anomaly is the most significant as an indication of the presence of syphilis. Other pupillary anomalies noted were the absence of the direct light reflex with the retention of the consensual reflex in two cases, and the fixation of accommodation with the presence of the reaction to light in two cases. The Wassermann test was positive in 47 cases (45 cases with positive serum tests and 2 additional in which it was positive in the cerebrospinal fluid and negative in the blood) or 4.7 per cent of the entire series of one thousand cases. It was positive in 26.7 per cent of the total number of cases showing pupillary anomalies. In seventeen other cases there is a history suggesting syphilis, or a total of 36.4 per cent of probable syphilitic cases. Thus in about 1 case in 3 showing a pupillary anomaly, one may expect to find other evidences of syphilis. The remaining 2 cases must be explained on a different basis.

In the present group, note was made of the various

general medical and surgical diagnoses. The following table lists in general the major groups:

Diagnosis	*Number of Cases Presenting Some Anomaly*
Fracture of extremity	21
Trauma elsewhere	14
Chest diseases (including pneumonia, empyema, pleurisy, tuberculosis, emphysema, asthma)	21
Gastrointestinal tract lesions (including carcinoma, gastric ulcer, cirrhosis, pancreatitis, colitis, hemorrhoids)	26
Localized infections (including cellulitis, ulcers, abscess, carbuncle, adenitis)	17
Hernia	15
Heart lesions of various types	14
Arthritis	4
Cerebral hemorrhage	5
Systemic syphilis	4

Conditions in which anomalies were less frequently noted include osteomyelitis, burns, trichinosis, uremia, arteriosclerosis, aortic aneurysm, ochronosis, alcoholism, rheumatic fever, gas poisoning, nephritis, cystitis, hydrocele, typhoid fever, food poisoning, varicose veins, lipoma, tuberculosis of the knee, poliomyelitis, amyotrophia, lateral sclerosis and alcoholic neuritis.

In a limited number of the above cases, the pupillary condition may be associated with the general condition, as in cerebral hemorrhage, chest diseases, aortic aneurysm, alcoholism and questionably some traumatic lesions, but in the majority of the remaining cases there is no such relation. In the absence of other evidences of syphilis, it seems unlikely that they suggest even distantly the early stages of neurosyphilis, although only observations extending over many years could definitely prove or disprove any relationship. Assuming there is a relationship between the pupillary anomalies and these few systemic conditions mentioned, there would still be approximately 33 per cent of cases unaccounted for by either syphilis or other systemic diseases.

Thus there is no adequate explanation either as congenital anomalies or as evidence of physiological (func-

tional) or pathological (organic) disease process for the occurrence of approximately a third of the pupillary anomalies observed in this general type of case. As has been suggested, these anomalies might be regarded as an indication of imperfect development or inferior quality of structure. The eye represents one of the most delicate mechanisms of the whole nervous system, a system itself which is perhaps the most sensitive to developmental influences in the entire body. That the normal structure and working efficiency of the iris mechanism might be a criterion of inferior somatic development as well as a very sensitive indicator of both central nervous system and general somatic disorder, is suggested by the findings in this study. The pupillary anomalies in these unexplained cases are regarded as such stigmata, accompanying but independent of other somatic disease and consequently without important diagnostic significance.

The Pupil in Diagnosis. The behavior of the pupil in the various pathological changes occurring both in the eye and in systemic conditions, should be well understood by the ophthalmologist, but the following outline by T. H. Curtin[1] will undoubtedly be appreciated by the general practitioner who has not familiarized himself with this diagnostic aid.

The author does not deprecate the use of all the scientific aids which have been given us in these latter years, particularly the various serological tests and blood chemistries, along with the advanced technic of *x*-ray and fluoroscope and transillumination; but we should not allow ourselves to become dependent entirely on these, but train ourselves to be keen observers; and at times it is most gratifying to find, in the use of these aids as a check-up, that we have been substantiated in our clinical diagnosis by the laboratory.

The pupil and its surrounding iris, located at the bottom of the anterior chamber, afford us an opportunity

(1) New York State J. Med., Jan. 15, 1928.

to observe through the clear cornea and aqueous the behavior of the otherwise concealed mechanism which has its connection with many localities of the brain, spinal cord and general nervous system. Irregularities in contour, position, color, size, and behavior are easily noticed and the clinical significance of each is so unvarying and far-reaching that not only ophthalmologists, but physicians, surgeons, neurologists, alienists and others familiar with the normal and abnormal pupil are (assisted by other symptoms) led to detect at once such profound systemic states as uremia, opium poisoning, belladonna poisoning, etc., or such grave cerebral states as apoplexy, tumor, abscess, meningitis, such nervous diseases as multiple sclerosis, paresis, tabes dorsalis, hysteria, as well as such alarming emergency states as shock, fatal syncope, sunstroke, exsanguination, epilepsy, tetanus, strichnin poisoning, hydrophobia, eclampsia and death.

Thus the state and behavior of the pupil is looked upon with concern by all who are familiar with the graver problems which confront the physician and surgeon as well as by the clinician in search of confirmatory evidence to assist in making a diagnosis of some obscure, incipient, vague or transitory malady affecting the cerebrospinal nervous system. For the proper interpretation of changes in the pupillary area it is necessary as in other organs of the body to know definitely its anatomy, physiology, its normal state in health in order to discern the abnormal or pathological. For in the most part this is relative.

The iris is the anterior segment of the tunica vasculosa, composed of structures partly ectodermal and partly mesodermal in origin, and affords valuable data open to naked eye inspection in cases of diseased states and congenital abnormalities of other parts of the tunica vasculosa which are concealed from direct, unaided inspection (the ciliary body and choroid) and

also in states referable to the nervous coat of the eye (the retina).

The independent innervation of the ciliary muscle on the one hand, and the iris on the other, the cerebral connection or association between the centers controlling ciliary action and those controlling pupillary action afford a fascinating study in cases where there is inharmonious action between the functions of these correlated anatomical structures; e. g., we may have normal accommodation and paralyzed pupils; we may have paralyzed accommodation and normal pupils; we may have pupils contracted and fixed to light, or pupils dilated and fixed to light, but which contract when the accommodation effort is used; or we may have both pupil and accommodation paralyzed or in a cramped or contracted state. Each of these problems has its clinical significance and they all afford interesting and valuable information.

But in certain diseased or abnormal states of one eye causing unilateral blindness we have the interesting phenomenon that the pupils of both eyes will contract when the normal eye is illuminated; but both pupils will remain unaffected when the blind eye is illuminated. From the misbehavior of the pupil in this so-called "*consensual pupillary action,*" useful if not indicative evidence can be deduced.

The cilio spinal centers controlling the dilator muscles of the irides are located rather far down in the spinal cord (or near the first dorsal vertebrae). The cervical sympathetic nerves emanating from these centers finally reach the dilator muscular fibers of the irides and hence it is that useful and valuable information is afforded to the clinician as to the state of health of these centers and of certain columns of the cord in their vicinity. There may be inverterately contracted pupils due to paralysis of function of the cervical sympathetic nerves as seen in tabes dorsalis and other similarly degenerated states of the spinal cord, or from

traumatism to the cord in this locality, causing the clinical sign known as "paralytic miosis"; or there may be dilated pupils through irritation of these nerves in states of functional irritation or inflammation of the cord, as seen in certain acute toxemic states or in peripheral irritations affecting the splanchnic nerves especially observed in children and expressed in twitchings, spasms, convulsions, etc., causing the clinical sign known as "spasmic mydriasis."

Brain cases. The comparative size and behavior of the pupils studied alone or in connection with optic neuritis, strabismus, nystagmus, hemiplegia, etc., afford information of inestimable value. Brain cases are seen where the important question as to localization was finally answered by the group of ocular symptoms aided greatly by the evidence afforded from pupillary behavior.

The width of the pupils varies in health from infancy to old age; and pupils often vary in size normally in the same individual. In infancy the pupils are contracted. In youth and adolescence, dilated, in the middle decades neither contracted or dilated, while in old age they are contracted. . . . The pupil is never seen to dilate ad maximum in states of health during middle years of life nor is there contraction of the pupil beyond a certain point, certainly not contracted as in the infant and the aged.

In the aged we find the pupil contracted. The common explanation of this is embraced in the comprehensive term, "hardening of the arteries." In senility the capillary walls are less resilient and, since the iris is a vascular membrane, we find it stiffened from vascular sclerosis.

Normal pupils are influenced by the following: (1) Light and Shade. (2) Sensory stimuli. (3) Drug influence. (4) Emotions. (5) Bodily disease. (6) Sleep, coma and death. (7) Cerebro-spinal nervous states and diseases. (8) Various other conditions as refractive

ones. The pupil is small in hyperopia and large in young myopes. We note that the pupils will contract in the light and expand in darkness. We also find that the pupil responds to the touch, as it were, for if the skin about the face or neck be irritated, or even if a painful inflamed part of the body like a rheumatic joint be pressed on, the pupil will dilate.

Among the drugs, one class known as mydriatics causes the pupil to dilate; another class known as miotics causes the pupil to contract.

The pupil also responds to emotions of a violent nature, such as anger, grief, passion, etc., psychic states in which we find it dilated. In sleep the pupils are contracted in spite of the fact that during sleep we are in darkness and the eyes are closed, conditions favorable to dilation.

In death the pupil dilates but not ad maximum. Among the cerebrospinal nervous diseases, we find interesting behavior on the part of the pupil. In tabes we find it contracted sometimes to a pin point, whereas in epilepsy and convulsions we find it dilated. Between these extremes we find many irregular and striking conditions of the pupil which aid greatly in fixing the diagnosis. But valuable as the pupil is from a clinical sense there is no single disease of the body which presents pathognomonic pupillary signs.

The color of the pupil varies in different periods of life; in childhood and adolescence it is a luminous black, in middle age it appears slightly dull black, or grey black, while in old age it appears gray.

There are two opposing muscles in the iris. One, the sphincter pupillae, is situated in the tissue of the iris near the margin of the pupil. It is the muscle which produces contraction of the pupil. The other, the dilator pupillae, is composed of radiating strands, which have their origin at the root of the iris and their insertion in the sphincter in which its fibers blend. This double-acting muscular apparatus is under the control

of, and is directly answerable to, impulses received through different nerve fibers.

The sphincter pupillae is supplied together with the ciliary muscle by a filament of the 3rd nerve conducted by way of the ciliary ganglion and ciliary nerves while the dilator of the iris is ennervated through the sympathetic the center arising around the first dorsal vertebra. The ciliospinal center—conducted by a complicated course through the inferior and superior cervical ganglion through the carotid plexis into the skull by the gasserion ganglion by way of the long ciliary nerve.

Normal pupillary reactions. There are two light-reflex pupillary tests in common use. The first is to determine the direct reaction which is produced when light and shadow are alternately made to enter the eye under observation. The second is the indirect, or consensual reaction as when light and shadow are alternately made to enter the fellow eye. Both of these reactions, when normal, are due to the integrity of the light reflex arc. The mechanics of the subject are embraced in the conversion of the one kind of energy (light), to another kind of energy (motion).

The associated reaction is a contraction of the pupil which takes place in the act of convergence and also of accommodation.

The direct reaction of the pupil to light is a test which is applied to determine the state of the retina, brain or spinal cord, e. g., dilated fixed pupil may indicate paralysis of the brain or of the pupil center of the brain, or it may indicate irritation of the spinal cord from any cause, and contracted fixed pupil may indicate irritation of the brain (meningitis) or paralysis of the spinal cord or certain tracts in the cord. The indirect or consensual reaction is a test to determine the status of the pupillary light reflex arc. The associated reaction test is made to determine the condition of the nuclear centers for convergence, accommodation and pupil contraction. The convergence reaction of

the pupil is the most powerful pupillary reaction and the accommodation reaction is the weakest.

I. The commonest known pathological pupil is the "Argyll-Robertson." In the Argyll-Robertson phenomenon, which is so commonly found in tabes dorsalis, we have contracted pupils at all times whether in darkness or light. The pupils do not contract to the light nor do they react when making the consensual test, but on employing the effort of convergence and accommodation they contract still further; so we have a negative direct and a consensual reaction and a positive reaction to convergence and accommodation. The Argyll-Robertson phenomenon is present in about 75 per cent of the cases of tabes. It is also frequently elicited in paresis; but here the pupils are not so contracted and they are apt to be unequal in size; moreover the phenomenon is apt to be of short duration in paresis, while in tabes when present it remains very constant. This pupil test is, therefore, very valuable in diagnosing tabes and paresis. The Argyll-Robertson pupil or spinal miosis may occur in other nervous diseases such as paralytic dementia, multiple sclerosis, injuries to the spine, etc. It never occurs in healthy individuals.

II. Physical reflex or cortical reflex is a dilation of the pupil through various mental stimuli. If a person makes a profound effort of the will, as in deep thinking or concentration, the pupils in health will dilate, or in terrified, angered or hypnotic states of the mind, they will also dilate.

III. Pain or sensory reflex has been referred to. When painful pressure is made on a sore spot anywhere in the body the pupils are seen to dilate. This is no doubt brought about through stimulation of the sympathetic nerve which supplies the dilator pupillae.

IV. Hippus is a bounding of the pupil noticed while the light is unaltered. It is present to a certain degree in health when it is called "oscillations of the pupil." There is an arhythmical contraction and expansion

noted while watching the pupil. It is no doubt incited from psychic influence, the patient is alarmed or apprehensive while undergoing the test. In certain cases of hysteria where there is a subnormal stability of the nervous system, and in some cases of meningitis, mania or partial blindness from optic papillitis, the pupil excursions in uniform illumination may be astonishing, actually boundng open and shut. This is "Hippus."

V. Paradoxical pupillary reactions are those which act just the opposite from normal. Paradoxical pupil behavior is an occasional symptom of disease of the cerebrospinal axis, e. g., tabes, paresis, dementia præcox, etc., or in functional neurosis, as hysteria.

Abnormal dilation of the pupil is called mydriasis and abnormal contraction of the pupil is called miosis.

Mydriasis occurs in glaucoma, double optic nerve atrophy or total blindness from any cause which does not destroy the eye balls. Mydriasis may occur from the following causes:

(1) Anything which interferes with the function of the pupillary light reflex arc at any point from the retina up to the brain centers and down again to the iris, e. g., increased cerebral pressure will cause mydriasis through paralysis of the nuclear centers. The commonest causes are paralysis of the third nerve from syphilis and ophthalmoplegia interna from degeneration of the cells in the pupillary center.

(2) Mydriasis may occur through psychic or cortical influence as in maniacal or frenzied states of the mind.

(3) Temporary anemia of the brain, as in fainting when the reflexes are abolished temporarily through heart failure, etc.

(4) Paralysis of the brain, as in fatal syncope, overdosing with general anesthetics, oncoming death, etc.

(5) Locally from certain mydriatic drugs such as cocain, atropin, deturin, dubosin, hyoscyamin, homatropin, gelsemin, euphthalmin, etc. Constitutionally from poisonous doses of certain other drugs as aconite,

cannabis indica, chloral, chloroform, cocain, conium, digitalis, ergot, gelsemium, nitrate of amyl, nitro-glycerine, sanguinaria, stramonium, turpentine, scopolamin, wood-alcohol, quinin, etc., some of these in physiological doses produce contracted pupils, but all in lethal doses produce dilatation.

(6) Dilation of the pupil also results from stimulation of the sympathetic nerve supplying the dilator pupillae, such as noted in sensory skin and painful pressure reaction, pinching the superior cervical sympathetic ganglion or sticking pins in it; spinal irritation from any cause such as traumatism, myelitis, spinal meningitis in early stages, gastric and intestinal disturbances, which incite unconscious states, as convulsions in children, as well as teething, shock, real and psychic, as a good spanking, a ghost story, night terrors, anything which "makes the skin creep and the hair stand on end," will stimulate the sympathetic nerves to the iris and cause pupil dilatation.

Contracted pupils are found in all inflammatory conditions of the eye.

Miosis—(1) Iritis, ulcers and abrasions of the cornea from congestion of the iris blood-vessels and reflex sensory irritation. The one exception is acute glaucoma.

(2) Plethoric states of the brain, as in acute high fevers, acute meningitis from any cause, uremia, alcoholism, etc.

(3) Paralysis of the sympathetic from any cause be it central, intermediate or peripheral.

(4) From certain drug influence as when eserin, physostigmin, pilocarpin, or arecain in solution is dropped in the eye.

(5) Poisons, inwardly, as opium and its salts, carbolic acid, creosote, alcohol in lethal doses, chloral at first, jaborandi, pilocarpin, muscarin, etc.

We should keep clearly in mind that paralysis of the sympathetic nerve from any cause contracts the pupil to a pin point (spinal miosis) and paralysis of

the brain causes widely dilated and fixed pupils; while stimulation of the spinal cord causes dilatation and stimulation of the brain causes contraction of the pupil. *In giving general anesthetics*, we must decide whether the sudden dilatation of the pupil, sometimes present is due to spinal irritation from gastric disturbance or whether there is oncoming paralysis of the brain. In suspected poison cases we must decide whether the contracted pupil is from opium or from uremia. In suspected "drunks" whether the contracted pupil is from meningeal irritation due to apoplexy, uremia or sunstroke. We must look at the pupils in suspected acute tuberculosis or pneumonia of one lung, for that slight dilatation is a diagnostic sign. We must note and understand that hippus is present in hysteria, chorea or mania, the widely dilated pupils due to increased brain pressure in brain tumors or brain abscess, the dilated pupil on one side in hemorrhage in one hemisphere of the brain, the Argyll-Robertson pupil in spinal syphilis, the unequal, deformed, and more or less fixed pupils in general paresis or cerebral syphilis, the normal pupils in sham fits.

Anisocoria or inequality. *Inequality of the pupils* occurs in healthy persons. If not associated with pathological conditions, it may be due to the following conditions: (1) Different refraction of two eyes. (2) Unequal illumination. (3) Unlike conditions—adaption of the retinae. (4) Inequality of action to closure of lids.

Anisocoria in some cases is due to irritation of the sympathetic, which is the enervator of the dilator of the pupil, illustrated by enlarged glands of the neck, aneurysm of the carotid.

In many intestinal diseases monocular mydriasis may be noticed as a symptom. Schauman estimates that 23 per cent of all internal diseases at some time during their course give rise to this symptom. He mentions appendicitis, diabetis, neurasthenia, lung affections, pleuritis, cardiac diseases, chlorosis, pernicious anemia.

There is one grave disease in which a partially and slightly sluggish pupil is a constant symptom and that is paresis. Cases have been reported of irregular pupils in arotic aneurysm; but on investigation were regarded as not due to cilio-spinal ennervation, but as due to syphilis of the venous system.

The behavior of the pupils in health and disease affords valuable and interesting study to any one who understands the impulses controlling the phenomena of pupil contraction, dilation and rigidity.

The Crystalline Lens

Non-Operative Treatment of Cataract with Report on Lens Antigen Treatment. Within the last few years the members of the medical profession have had many new discoveries displayed before them for their approval, a few of value, others of no worth. Perhaps the one that ophthalmologists should be especially interested in is the announcement by A. E. Davis that he had arrived at a cataract preventive or cure without resort to surgery. [This report was published in the 1926 volume of the Practical Medicine Series. The number of letters received by the Editor asking for further information, is evidence of the widespread interest the article aroused among ophthalmologists.—Ed.]

In his more recent report he announces that 72 patients with 131 cataracts had been treated. Of these cases he reported 36 cases or 27½ per cent as being arrested cases, in 86 cases or 65 per cent the cataract was either cured or improved, making a grand total of 93 per cent of the cataracts which had responded favorably to his treatment. Such a "cure" if based on scientific truth is of the utmost importance, for the disease entity known as cataract is an ancient one, and has withstood the attack of ages of learned men who have

sought to conquer it by every conceivable remedy other than the knife, with little or no success.

Such a revolutionary discovery as the finding of a mode of treatment which gives arrest in 85 per cent of the cases treated and improvement in over 50 per cent of the cases treated is worthy of further study by others of an unbiased mind. If these facts be true and we have a real definite mode of treating cataract of whatever form, it is vital that this fact should be broadcast not only to the medical profession but to the laity generally so that all may share in the benefits to be derived, for cataract is a common medical condition and if it is possible in early cases to stop the progress of cataract, the people generally should be as acquainted with the fact as they are now with the necessity of early treatment of cancer and tuberculosis and diabetes. If in addition to being able to prevent the formation of cataract in the early cases we can promise half of our cases cures after the cataract has formed and that the opacities will clear up, we truly have a remedy of inestimable value.

The ophthalmologist asks, are these facts true? He turns to the American Medical Association and enquires of the Council on Pharmacy and Chemistry whether the lens antigen treatment of cataract has been passed upon by their board and he finds that while this preparation has been presented to them they have not passed upon it, for the ophthalmologists consulted all agree that the evidence of its usefulness was not acceptable. They await more evidence. It should be for ophthalmologists themselves to inform the council as to its efficacy and advocate its approval or disapproval by that impartial board.

In order to satisfy himself more fully as to the efficacy of this treatment, Z. H. Ellis[2] treated a number of cataract patients by this method. Before starting the treatment of these cases he conferred with Dr. Davis,

(2) New York State J. Med., Dec. 1, 1927.

and followed directions given by him. The patients were instructed to be abstemious regarding the use of alcohol and tobacco. They were told to drink three extra glasses of water daily, and to eat meat only once a day and then in moderation. They were given 10 c. c. of potassium iodid three times a day by mouth. On the first day one minim of lens antigen was injected intracutaneously, and on the following day the site of the injection was examined to determine the amount of severity of the reaction. They were then injected subcutaneously with ½ c. c. of lens antigen. The following day they were given 1 c. c. The injection was increased 1 c. c. per day until 10 c. c. were reached. Some of the cases were run up as high as 15 or 18 c. c. per injection. The injections were given daily except on Sundays.

As some of the cases treated by lens antigen showed a stationary condition or very slow progress of the cataract, which might or might not be claimed to be due to the treatment which the cases received, it seemed wise to study a group of cases which have had no treatment whatever, either internal medication, drops or injections which also show a stationary action on the part of the cataract. In some of these cases there appeared to be a slight improvement in vision. This probably is not due to the absorption of lens opacities but more apt to be due to either a better refraction at a later date, or else due to the fact that as the patient became more accustomed to the doctor there was better cooperation between the patient and the examiner. Anyone doing a great deal of refraction on cases with lens opacities appreciates the fact that the mental attitude of the patient has a great deal to do with the vision which the patient has. It will also be noted that in some cases the opacities in one eye developed more rapidly than those in the other, although in all of the cases selected the growth of the cataract was slow. These cases are presented to confirm a well established ophthal-

mological fact that some cataracts do become stationary and do not go on to maturity over a long period. This fact has been well established in the minds of ophthalmologists.

Fourteen control cases are presented, all of which show in one or both eyes lens opacities which were stationary under observation for several years.

The patients that were treated were told that we were experimenting with a substance which we have every reason to believe would cure them of their cataracts and that it would not be necessary to operate. They were told, however, that in case the treatment failed to give them the desired relief, they would still have operative procedure to fall back upon.

Only one case in the series developed anaphylactic shock from the injections. This was a true anaphylactic shock, as it came on at the end of the thirtieth treatment. The patient was unconscious for five or six minutes but later responded to an injection of adrenalin. About one-fourth of the cases developed a mild dermatitis at the seat of the injection and complained a great deal about the itching accompanying the dermatitis. The area at the seat of the injection in these cases was raised and the patient had an elevated temperature. These skin reactions were of various sizes and shapes and varied greatly in severity. No inflammatory reaction of the eyes was noted in any of the patients treated.

Summary

Types of cataracts treated—

Traumatic	2
Cortical	15
Sclerosed Nucleus	5
Diabetic	4
Complicating Glaucoma	1
Total	27

Cases which showed progress of the cataract—14.

Cases which showed no change in the progress of the cataract—13.

Cases which showed absorption of the cataract by

slit lamp examination or improvement in vision—None.

Practically all of the cases noted a general tonic effect from the lens protein.

Cataract Extraction. A report of 300 cases of cataract extraction, from the Ophthalmologic Clinic of the University of Michigan, is given by Walter R. Parker[3] primarily as a study of the comparative results obtained in three series of 100 consecutive cases in which operation was performed respectively by the combined, the simple and the Knapp-Torok methods of procedure. As a matter of record, there is included a table showing the incidence of the following complications: loss of vitreous, spontaneous hemorrhage, iris prolapse, infection, secondary glaucoma, average astigmatism and cataract delirium. Cases in which iridectomy had been performed previously, either as a preliminary to extraction or for the relief of glaucoma, are omitted from the series.

There is something to be said in defense of each method. The elimination of certain cases, however, especially when the vision is only slightly below the accepted standard of 6/12, injects a complication that is not always easy of solution. By including all cases, the result expresses the average risk the patient takes, and, for comparative study, for the variables may remain as nearly constant as they would if one attempted to classify the cause of diminished vision in each case. Again, if one were to eliminate all conditions that might contribute to a faulty result, the character of the cataract should be considered, and this usually is not done.

In this report, the calculations are based on the total number of recorded cases. It includes a series of cases out of which were selected certain ones deemed suitable for the simple or Knapp-Torok method of extraction; in the remaining cases the combined method of extraction was used. Some of the patients operated on ac-

(3) J. A. M. A., Dec. 31, 1927.

cording to the combined method were suitable for one of the other procedures—one-eyed patients for instance —but in all cases classified as complicated the combined method was used, and the results are included in this report.

The choice of a simple operation was based on the presence of a large cornea, a dilatable pupil and occasionally the request of a fastidious patient. The Knapp-Torok operation was chosen only when the patient was 60 or more years of age, had a large cornea, had a dilatable pupil, and was apparently under good control. The Knapp-Torok operation was successful in more than 61 per cent of the attempted cases. When the capsule ruptured, the case was not included in the combined series, nor were accident extractions in the capsule included in the Knapp-Torok series. In each case, the classification made prior to operation was adhered to.

Visual results obtained in each case are given, together with the average visual acuity of 6/12 or better obtained in each series of cases. The records were complete in ninety-eight of the combined cases, eighty-nine of the simple and ninety-nine of the Knapp-Torok.

	Per Cent 6/12 or better
Combined	71.4
Simple	70.7
Knapp-Torok	63.6

The best average visual result of 6/12 or better was obtained in the cases in which operation was performed according to the combined method, in spite of the fact that all known complicated cases were included in this series.

	Combined	Simple	Knapp-Torok	Total Cases	Percentage
Loss of vitreous	4	2	6	300	4.0
Spontaneous hemorrhage	1	0	0	300	0.33
Iris prolapse	1	6	2	300	3.0
Infections	0	1	1	300	0.66
Cataract delirium	3	0	1	300	1.33
Secondary glaucoma	0	0	2	300	0.66
Secondary cataract	14	30	3	300	...
Average astigmatism	2.6	1.9	2.6	300	...

Spontaneous Hemorrhage. A spontaneous hemorrhage occurred in one case immediately following delivery of the lens by the combined method. The patient was old, with advanced arteriosclerotic changes, but there was nothing noted that suggested the possible occurrence of this serious accident.

Prolapse of the Iris. The iris prolapsed once in the combined, six times in the simple and twice in the Knapp-Torok series, or in 3 per cent of the total 300 cases. Atropin was instilled in all the simple cases before and at the time of operation. The same procedure was followed in the other cases except in those showing evidence of increased intra-ocular pressure.

Infections. There were two cases of panophthalmitis, one in the simple and one in the Knapp-Torok series. Both were acute cases that evidently became infected, either at the time of operation or immediately after. Bacteriologic examination showed pneumococcus in one and *Staphylococcus aureus* in the other. The bacteriologic examination in the pneumococcus case was reported as negative at the time of operation and did not show any evidence of infection. The other case was reported as having given a sparse *Staphylococcus albus* culture but did not show any more evidence of infection than many other cases in which the patients did well.

Secondary Cataracts. It is sometimes difficult to state definitely just what effect a thin membrane may have on the visual acuity. Occasionally, a patient in whom the membrane appears complete will have a good vision, while another with an apparently similar secondary cataract will have the vision seriously impaired before it is divided, and will be markedly improved by an operation.

Slit lamp studies were not complete, and doubtless future reports will be more satisfactory in this regard.

Cases of Secondary Cataracts

	Number	Operation
Combined	14	7
Simple	30	7
Knapp-Torok	3	2

The dense membranes that developed in the Knapp-Torok cases were classified as secondary cataracts. Two of those were divided and a good opening was obtained. The final vision in one case was 6 7.5; in one, 6/30. In the latter case, the patient had a degenerated vitreous and marked choroidal changes. The low vision obtained could not be attributed to the method of extraction employed. In one case the membrane was not divided, and the final record was not obtainable.

Astigmatism. An attempt was made to determine the average amount of astigmatism present at the time of the last refraction. This, like the visual acuity, may vary with the time that elapsed after the operation. The total amount of astigmatism in each series was divided by the number of recorded cases with the result in diopters as shown.

Amount of Astigmatism Present

	Average Amount of Astigmatism, Diopters
Combined	2.6
Simple	1.9
Knapp-Torok	2.6

Cataract Delirium. Delirium was recorded in four cases, three in the combined and one in the Knapp-Torok series. In all, the patients made good recovery, and the final visual acuity was not affected by the temporary loss of coordination.

Visual Acuity

	Recorded Cases, Number	Vision 6/15 or Better, Number	Vision 6/15 or Better, Per Cent
Combined	98	75	75.5
Simple	89	67	75.2
Knapp-Torok	99	74	74.7

Conclusion: 1. In selected cases, the simple or Knapp-Torok method of extraction may give as good results as the combined method in unselected cases. 2. Secondary cataract is present more frequently in the simple than in the combined method of extraction.

3. By inference one may conclude that the combined operation in selected cases would give the best results and in general should be adopted as the safest method of procedure.

Otis Wolfe[4] speaks of the advantages of the *intracapsular method of cataract extraction,* and believes the Barraquer technic is the best intracapsular method. It offers the patient the quickest and surest path to restored vision. The procedure is more exacting, but the end justifies the means. Smith says, "The intracapsular operation is a specialty within a specialty." After all is said on the subject, one can rest his argument of the merits of any cataract procedure on visual results. The function of the eye is to see. The method that consistently gives the best vision with the shortest loss of time to the patient is the ultimate operation. The author quotes a number of operators whose conclusions coincide with his.

The young surgeon of today contemplating his first cataract extraction is confronted in the literature with such a maze of methods, and may be so baffled by the multiplicity of technics advocated that he is often defeated before he begins by the acquirement of a lack of confidence in himself. While the successful cataract surgeon must be cautious he must by no means be timid. In developing the self-reliance so necessary to such intricate surgery as that involved in removal of the crystalline lens it is necessary that the surgeon knows that he will have full command of any situation which may present itself. With a simple, workable technic, freed from the pitfalls of the many surgical fads that literally crowd our literature, the cataract operation becomes such a simple procedure that it should not, and will not in the least, interfere with the poise, and therefore the success, of any one versed in the principles of surgery.

(4) J. Iowa M. Soc., February, 1928.

[D. T. Atkinson[5] offers some excellent advice on the various steps of cataract extraction which can be read with profit by the young surgeon.—Ed.]

Two safety measures in the extraction of cataract are discussed by W. S. Atkinson[6]. They are paralysis of the orbicularis, and closing of the wound with sutures.

Paralysis of the orbicularis in cataract extraction by infiltration with novocain to block the branches of the seventh nerve supplying this muscle is safe, easily produced, and makes the operation much simpler. The object should be to get complete paralysis of the orbicularis and one should not confine himself to any one method of infiltration to obtain this end. In uncomplicated cataracts it eliminates the most common cause of loss of vitreous. It also helps to prevent serious loss of vitreous in dislocated and subluxated cataracts. With the lids temporally paralyzed the introduction of a suture is made much easier. Closing of the wound with sutures is desirable and the advantages are many as compared with the disadvantages. Sutures placed nasally and temporally help to prevent prolapse of iris. A needle holder without catch, fine sharp needle, with 00 silk, and forceps for tying that do not allow the silk to slip, add to the ease and safety of the procedure.

The Retina

Retinitis with Massive Exudates. The white spots that appear in the retina as the result of kidney, heart, or vascular disease, diabetes, or syphilis are seen so frequently that even an ophthalmologist of little experience can readily make the diagnosis. Those due to tuberculosis are rarely seen and are not always characteristic, so that the diagnosis is made on a consideration of the associated history rather than on the

(5) Eye, Ear, Nose & Throat Monthly, May, 1928.
(6) New York State J. Med., Dec. 15, 1927.

retinal picture. But there is a retinitis seldom seen even by oculists of large experience but which once observed and studied can never be mistaken for anything else. L. W. Jones[7] describes the case of a nine year old boy, who had been advised by the school doctor, to see an eye doctor and be examined for glasses, as he had poor vision in his right eye.

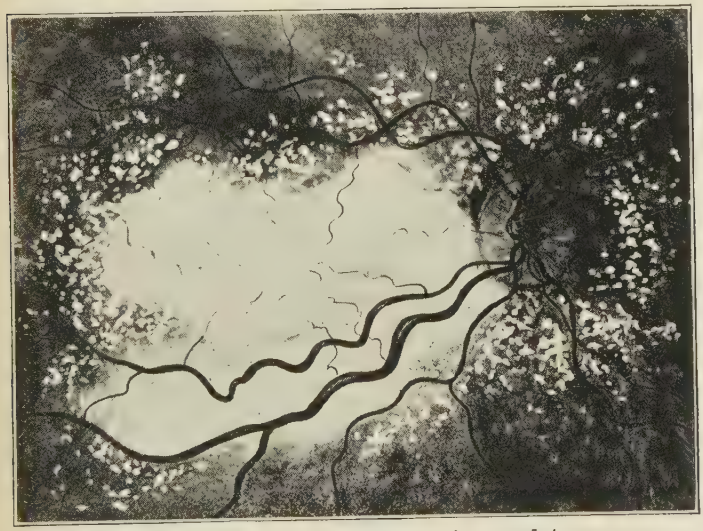

Fig. 21.—Retinitis with massive exudates.

That was practically the entire history. He had never had sore eyes, did not know his vision was defective, and beyond one or two of the usual children's ailments he had never been sick. The boy was a well nourished lad. He had recently made a slight gain in weight. His only complaint was of a slightly swollen cervical gland on the right side.

Right Eye: Vision of large objects. Can see fingers at one foot but counts them inaccurately. There is no external evidence of any pathology. The pupillary re-

(7) Am. J. Ophth., January, 1928.

actions are normal and the media are clear. The optic nerve is of good color, showing neither pallor nor congestion, and there is no swelling of the disk.

Beginning at the upper limit of the nervehead and extending over to the temporal region of the retina, there is a yellowish white, waxy area, which occupies almost the entire lower and outer quadrant of the fundus. (Fig. 21.) This area is almost solid white in color except for a tongue of greenish yellow pigmentation extending into the region of white, a little below and to the temporal side of the disk. The retinal vessels cross over the white field and are not covered by the exudate, if such it is.

Above the field just described are numerous flocculent or mutton-fat patches, extending upward as far as the eye can see and resembling the deposits of an albuminuric retinitis. These flocculent patches of white are also in evidence below the main area, although to a less degree.

In the region of the inferior temporal artery the retina appears to be detached, for the vessels here can be seen with a plus 5.00 D. lens as compared with a plus 1.00 D. lens in the upper and central fields. Between the temporal side of the disk and the beginning of the white area is a narrow band of choroidal pigment; and, if the patient turns his head to the extreme right, there are a few punctuate spots that look like minute capillary aneurisms or dilatations.

A physical examination of the boy gave no clue as to the etiology of this exudate, there being neither sugar nor albumen in the urine, the Wassermann negative, the lungs clear, and no manifest focus of infection being present.

It was easier for the writer to say what the disease was not rather than what is was, but on seeing the case A. C. Snell named it "angiomatosis retinæ or von Hippel's disease," whereas John Gipner, to whom the writer is indebted for the very careful painting of the

ophthalmoscopic picture, called it "retinitis exudativa or Coats' disease." Snell had seen one other case in his own practice and Gipner one or two at the Mayo Clinic.

In 1908, in the Royal London Hospital Reports, Coats described a group of cases characterized by the presence in some part of the fundus of an extensive mass of exudation, and in some cases found associated with this a peculiar form of vascular disease, with fusiform and globular expansions, kinks, loops, and glomeruli. In the disease as described by Coats, the white exudate is the prominent feature of the retinal picture. When the blood vessel changes are the outstanding characteristic, the disease comes under the description of von Hippel's retinitis, or angiomatosis retinæ. In this case the blood vessel changes are confined to a few small dots at the extreme temporal border, while the exudate is by far the more prominent feature.

Fuchs states that these masses of exudate are usually elevated above the level of the retina and may project like a veritable tumor. This may explain the apparent pushing forward of the retinal vessels in the lower part of the field of this boy's eye, as the picture is not typical of ordinary detachment.

In meeting for the first time an unusual condition such as this peculiar retinitis, the ophthalmic practitioner, in his service to the patient and out of scientific interest in his specialty, will naturally demand from the literature of the subject an answer to these questions: (1) What is the cause underlying this retinitis? (2) Can the condition be cured? (3) What is the probable outcome? (4) Are von Hippel's retinitis and that of Coats one and the same disease? (5) What does the microscope show? (6) How frequently does such a retinitis occur?

Etiology: Coats' conclusion is that the most careful physical examination fails to discover any probable etiology. The affection usually occurs in young males

in apparently good health, although Snell's case was in a young girl.

Szmaj reports three cases supposed to be tuberculous, and Dodd reports the case of a sixteen year old girl with retinal exudates, in whom intradermal tuberculin gave a strongly positive reaction and tuberculin treatment caused subsidence of the retinitis, leaving in its place white bands. Davis reports the case of a ten year old boy who improved under tuberculin. Tuberculin has been tried on this patient without any effect Sattler and Leber think that the cause is of an embolic toxic nature.

Carsten, apparently favoring the hemorrhagic theory, reports the cases of two out of three young men whose coagulation time was normal and who yet showed some improvement following the use of an antihemorrhagic compound known in Munich by the name of "Clauden".

Coats found microscopic evidence favoring hemorrhage as the cause of the exudates, but against this as a primary cause must be set, so he says, the youth of the patients and the fact that the disease is usually unilateral.

Can the disease be cured? If that means restoration of sight, the answer is "no". The condition usually goes on to detachment of the retina, secondary glaucoma, and total blindness. There have been isolated cases in which either with or in spite of medication such as described above, the process was temporarily or permanently arrested. Fortunately, in the exudative form the condition is usually confined to one eye.

Is *Retinitis exudativa* or *Coats' retinitis* the same disease as *Angiomatosis retinae* or von Hippel's disease? In his original article Coats speaks of retinal angiomatosis as an allied form or a variety of the same form as retinitis exudativa. But he concludes by saying that the few pathological examinations that have been made do not altogether support the theory that these are one and the same disease, and that in the meantime there-

fore it is better to classify them separately. Fuchs regards them as variations of the same disease, whereas Swanzy lists them as two separate conditions.

Pathological examination: Coats found that the white mass was due to a disintegrating hemorrhage seen through a retina which was thickened and infiltrated with swollen leucocytes. The hemorrhage was connected with the outer strata of the retina and was therefore derived from the capillaries of the outer reticular layer. It had broken into the subretinal space, and at its periphery slow organization was taking place.

According to Swanzy, the most constant microscopic lesion is a fibrous tissue mass between the retina and the choroid, with evidences of degenerative changes. In many cases the retinal vessels show various forms of disease.

Frequency: The few authorities that list this disease classify it as rare. According to A. C. Snell, there is in the literature, including his case shortly to be reported and that of this patient, a total of about forty-two cases. While granting that a number more have escaped either recognition or publication, the total number of such cases must still be very small.

The Retinal Circulation. P. Brailliart describes some pathological changes occurring in the retinal circulation. Translated by J. E. Lebensohn[8].

The consequences of arterial obliteration.—The loss of blood supply induces atrophy of the nerve-fibers and of the ganglion cells. Elschnig and Von Nuel noted that the atrophy was considerably advanced by the fifth or sixth week. After but six days, Siegrist was able to perceive definite signs of degeneration—effacement of nuclei and cell markings, and formation of vacuoles, homogeneous masses, and myeline droplets in the nerve bundles. Clinical observations have demonstrated that after six to eight hours of obstruction the re-establish-

(8) Eye, Ear, Nose & Throat Monthly, February, 1928.

ment of the circulation will bring but a partial return of visual function.

Experimenting on the rabbit, Baquis found that compression of the central artery maintained but for 15 minutes produced transient lesions of the ganglion cells (healing occurring in eight days); but if the circulatory obstruction was continued for 30 minutes, more or less marked permanent destructive lesions resulted.

R. Sand has shown that total arrest of the cerebral circulation cannot be tolerated by mammals for more than 3 to 25 minutes. After this period the brain can still be revived but with resultant serious functional disorders and pathological changes.

The prognosis of acute obliteration of the central artery is indeed grave. The vision remains lost, except in the rare cases (probably due to arterial spasm) where the circulation was very early re-established. Occasionally a luminous sensation persists in a portion of the temporal field. In some cases this is apparently due to the existence of a cilio-retinal artery; in others, the explanation perhaps is that the nutrient capillaries are derived from beyond the obstruction.

Frequency of acute arterial obliteration.—Acute obliteration of the central artery occurs rather infrequently. In Hirschberg's clinic there was one to every 1,300 eye cases. Dufour and Gonin in the hospital at Lausanne noted one to every 2,400 patients; Schöbl, one to 5,000; Wuttich, one to 10,000.

The two eyes may become affected simultaneously, or after a more or less intervening period. Harms has collected 20 such cases from the literature. In three of these both eyes became blind within a few minutes. Van Duyse's case concerned a man aged 71 with mitral insufficiency, who on leaning forward was in three minutes affected by bilateral blindness.

Fisher, in a study of 200 cases, finds that the right and left eyes are statistically about equally affected. He points out, however, that cerebral apoplexy affects

mostly the left side, because the left carotid for anatomical reasons is more exposed to emboli. It seems hence probable that if the statistics included only those cases of acute obliteration due to emboli, they would show a predominant incidence on the left side.

Obliteration of branches of the central artery.—Should the obliteration affect a branch artery, the ophthalmoscopic examination will definitely show arterial contraction, and a milky retina in the involved zone. The visual field will show a blind sector corresponding to the artery affected. Any branch may suffer; in several observations a cilio-retinal artery has been obstructed, with a resulting central scotoma.

The nature of the obliteration.—The principal ophthalmoscopic signs of thrombus and embolus are the same. Patients affected with thrombosis usually have hypertension and often give a history suggestive of previous local or systemic arterial disturbance.

Embolus is generally derived from a mitral lesion. A sudden attack of blindness coming on one thus affected would hence probably be due to embolus. The embolus can be but rarely actually observed. Hess examined a woman with heart disease, 54 years old, 10 minutes after the loss of vision. After massage, the embolus became visible at the origin of the superior branch as a tiny white cylinder. Further massage caused the embolus to advance to the next bifurcation. The following day the embolus was absorbed and the vision was 20/25.

Sometimes there is seen on the disk, just below the embolus, a sacciform aneurysmal dilation of the trunk of the central artery. This aneurysm, which pulsates on ocular compression, disappears in several days.

Chronic obliteration of the central artery of the retina.—As a result of endarteritis the blood supply of the retina becomes progressively more and more reduced. The retina becomes pale, the vessels narrowed, and the pulse reaction to ocular compression feeble. The

difference between the retinal systolic and diastolic pressures is definitely less than normal. The veins are also narrowed, and the color of the venous blood approaches that of the arterial; the venous pulse can no longer be induced.

In more advanced cases white sheaths encircle the arteries. The inhalation of amyl nitrite in these cases will for an instant improve the precarious circulation.

The disk is more or less pale; this atrophy is due to similar lesions of the vessels supplying the optic nerve. The disk may also become excavated. Schnabel claims that excavation of the optic disk is essentially due to the formation of small gaps in the interior of the nerve. Moxas has elaborated this conception. He believes these lacunæ are formed as a consequence of the anemia resulting from vascular obliteration. In glaucoma this anemia is induced by the compression of the capillaries of the optic nerve and retina.

Functionally, the vision becomes less and less; the visual field becomes contracted, and small central and paracentral scotomata appear. Rarely does absolute blindness supervene. The inhalation of amyl nitrite, in improving the circulation, produces a transient subjective improvement in vision.

Juvenile recurrent hemorrhage of the retinovitreous area, according to a statement made by Suganuma[9], is exclusively caused by tuberculous periphlebitis of the retina. As a rule this is primary in the eye. The tubercle bacilli are brought to the eye by the blood from other parts of the body, are transferred probably in the ultracapillary part of the vessels to the perivascular lymph space, gather in the most favorable places, and produce specific nodules around the veins. Exceptionally it is possible that tuberculous periphlebitis of the retina is secondarily derived from disease foci in the anterior portion of the eyeball.

(9) Arch. f. Ophth. (Graefe's), 1927, p. 443.

Hereditary Optic Atrophy. Leber in 1871 first described hereditary optic atrophy or Leber's disease, although von Graefe had described a case as early as 1858 and Beer had drawn attention to the conditions in 1917. A brief resumé of the disease is here given by G. H. Hogg[1]. The onset of the disease is rapid and is often unnoticed until the sight has failed considerably. It usually affects the two eyes simultaneously and to much the same degree, although one eye is sometimes affected later than the other; very rarely one eye may escape.

The sight fails quicky, so that in a few weeks vision may have fallen to 6/60 or even to counting fingers at a short distance; then as a rule no further loss occurs and indeed some slight improvement may set in. Fortunately the disease never goes on to total blindness, so that the patient usually retains enough vision with which to get about.

Nettleship, Lawford, Batten and others have reported cases in which almost complete recovery has taken place.

The field of vision is not contracted as a rule, but there is a central scotoma for white and colored objects varying in degree. Frontal headache is not infrequently complained of. Ophthalmoscopic examination may reveal in the early stages a slight congestion and redness of the optic disk with more or less blurring of the margins and this appearance may continue for many weeks. In time the disk becomes pale and atrophic looking, although the atrophy never becomes so great nor do the blood vessels become diminished in size as in primary atrophy.

The usual age of onset is about twenty years, although it may be earlier as well as much later. A case has been recorded in a patient as old as sixty. The age period is usually about the same for all members of the same family and in these families in which the onset is early,

(1) Brit. M. A., Oct. 26, 1927.

some females are usually affected. When the onset is late, female patients are few in number. Anticipation is, according to Nettleship, fairly well marked, the disease manifesting itself in the members of each succeeding generation at an earlier age.

Some concurrent condition may possibly play a part in exciting the development of the disease in a member of an affected stock, thus Hogg has seen some in whom the excessive use of tobacco was possibly to blame, and Nettleship notes that the presence of diabetes may have predisposed to its onset.

The disease is much more prevalent in males, although it is met with in females rarely. Nettleship's statistics included three hundred males and sixty females, but he was of the opinion that the number of male patients was in excess of this, the reason being that more cases of females are recorded because of their rarity. Leber's proportion was one female to nine males.

Pedigrees show that it is the males of a family who are usually affected, and that the females escape, but that descent takes place through the female line, a male suffering from Leber's disease seldom transmitting it. An affected female very rarely gives the disease to her sons, but Nettleship believes that she does transmit it to a larger proportion of her descendants than if she carried it latent in the ordinary way.

Several observers state that epilepsy and hysteria are occasionally found in the families affected with Leber's disease and a high early mortality has been noted, especially among the male children of some of the affected genealogies, their longevity, however, being about normal.

It may be interesting to note in relation to Leber's disease, that Dr. James Taylor and Dr. Gordon Holmes in 1913 drew attention to certain cases of nervous disease associated with an optic atrophy of familiar type, in which the general symptoms were absence or diminution of the deep reflexes, numbness or tingling

in the limbs, most commonly in the feet and hands, pains of a dull aching character and areas of anesthesia and analgesia; slight sphincter troubles were present in some and in a few of the patients there had been slight mental disturbance at an early stage of their illness. Slight mental symptoms, such as depression, irritability, weakness of memory, dullness have been said to occur in Leber's disease.

When one sees the comparatively slight inflammatory condition in the optic disk at the beginning of the disease, it is difficult to realize that so slight a change is the prelude to extensive loss of vision. Unfortunately we have no *post mortem* examinations to inform us as to changes in any part of the optic tract, so that the pathology of the disease is unknown. All that we can say is that there is a retrobulbar neuritis followed by atrophy of the papillo-macular fibers chiefly. The difficulty lies in explaining: (1) Why only certain fibers are affected, (2) why both nerves are attacked simultaneously and symmetrically, (3) why the disease occurs chiefly in the male sex and at certain ages, (4) why females alone transmit the disease.

As regards (1) and (2) we know, of course, that certain poisons, such as tobacco and alcohol, can produce somewhat similar symptoms, so that we may conceive of some autotoxin as the cause, but (3) and (4) still require explanation and to refer the disease to the laws of Mendelian inheritance helps but little.

Fisher has propounded a theory that the disease may be due to some disturbance or enlargement of the pituitary body implicating the visual pathways and that this tendency to pituitary disease may be inherited. He suggested that at the sexual epochs of life changes occurred as physiological processes in the pituitary body and that it was an exaggeration of these with tumefaction which mechanically produced the visual phenomena of Leber's disease. In support of this view he produced some *x*-ray evidence and since then many

cases have been published as showing enlargement of the pituitary fossa.

An article by Schüller, of Vienna, on the *sella turcica*, states definitely that the pituitary gland may be hypertrophied without causing a visual enlargement of the *sella*, that the shape and size of the pituitary fossa vary and that there are several types dependent not on the pituitary gland, but on the conformation of the phenoidal sinus; the different kinds of bridges which have been described as pathological are really normal.

On the other hand, Timme states that enlargement of the pituitary gland may produce erosion and enlargement of the fossa and is the cause of some of the varieties of migraine, *x*-ray examination in such cases showing erosion of the clinoids, enlargement of the cavity itself and even a breaking through of the walls.

On the whole the evidence in favor of Fisher's theory cannot be regarded as conclusive, nor is it easy to postulate a transient disturbance of the pituitary gland causing this form of blindness, although Timme's views about pituitary inadequacy associated with small *sellæ turcicæ* of hereditary character must be borne in mind.

Retrobulbar Neuritis. Records of thirteen cases of retrobulbar neuritis are detailed by Karl Mylius[2]. In all of them striking improvement followed daily intranasal treatments with cocain on an applicator followed by a tampon soaked in 1 to 1000 solution of epinephrin. The author never noted harmful effects of the therapy. Though he believes that the great improvement was directly due to the treatment, he does not regard it as proof that the retrobulbar neuritis was rhinogenic. In some of the cases the neuritis was unquestionably the result of multiple sclerosis. The treatment was effective in several cases in which recovery had come to a standstill spontaneously or following other therapy.

Since the work of Herzog, Mylius feels that the rhinogenic origin of retrobulbar neuritis is overemphasized.

(2) Zeit. f. Augenh., January, 1928.

Herzog demonstrated the ease with which inflammatory processes can pass from the sinuses to the dural sheath of the optic nerve, and showed histologically that in many cases sinus processes exist despite negative rhinologic, roentgenologic, and gross anatomic findings. There is inflammation in the medullary cavity of the bone contiguous to the sinus, and there are demonstrable direct connections between the submucosa of the sinus on the one hand and the dura on the other. Mylius, however, emphasizes the fact that exhaustive studies (vision, field, dark adaptation, and ophthalmoscope) of the eye in a large series of cases of undoubted sinus disease revealed no evidence of optic nerve affection.

A case of *central amblyopia* in a diabetic tobacco addict, is reported by S. Holth[3]. The patient was fifty-eight years old and an inveterate smoker. His vision decreased steadily and a central scotoma for white and colors appeared. The urine showed considerable sugar. Abstinence from tobacco was recommended but the patient continued to indulge. After insulin was used to relieve his diabetic condition vision greatly improved and the scotomata cleared, in spite of constant use of tobacco.

Acute Optic Neuritis and Maxillary Sinusitis of Dental Origin. A case was reported by H. La Grange and P. Mathieu[4] of a thirty-eight year old woman, whose vision in the right eye had fallen to one-third, and the visual field of this eye was contracted. The vision of the left eye was normal. Radiography showed great opacity of the right maxillary sinus. A large core ("bourbillon") was removed through a trephine opening in the sinus. Culture disclosed a streptococcus of the hemolytic series, and antistreptococcic autovaccine was resorted to. A juxtapapillary hemorrhage was rapidly absorbed and the vitreous cleared up, the vision of the affected eye becoming normal two months later.

(3) Acta ophth., v. 5, 1927.
(4) Bull. Soc. d'Opht. de Paris, July, 1927.

Juvenile Atrophy of the Optic Nerve. As a cause of blindness in children and adolescents optic atrophy has not received the attention it deserves. From statistics compiled by H. D. Lamb*, of 559 pupils in attendance at the Missouri School for the Blind during the last 23 years, 84 or 15 per cent had lost their sight from optic atrophy, the second largest single cause of blindness.

A gradual diminution in the amount of juvenile optic atrophy in this school is clearly indicated although the changes are not great. Nevertheless the number of optic atrophy cases among new pupils entering the school between 1920 and 1925 was two more and between 1925 and 1928 was one more than the number of cases of ophthalmia neonatorium entering in the same periods.

Among 1272 pupils attending 10 schools for the blind in this country during the last 15 years, 223, or 17.5 per cent had lost their sight from optic atrophy—the greatest single cause. We thus see ophthalmia neonatorum again surpassed as the greatest single cause of blindness in youth. A shifting of forces is thus plainly indicated in work for the prevention of blindness.

Among 254 adult cases of optic atrophy in St. Louis City and the five counties of the state having populations greater than 60,000, 18, or 7 per cent, had lost their vision under 30 years of age.

N. Bishop Harman reported 222 cases of optic atrophy with or without disseminated choroiditis among 1100 children in London schools for the blind, a percentage of 20.2 per cent, the second highest single cause of blindness. The author also stated that in 125 of these 222 children syphilis was definitely present, in 13 syphilis was probable and in 64 there were mental defects.

H. Frese found 143 cases (98 boys and 45 girls) of optic atrophy among 849 youthful blind students at the Federal Institute for the Blind at Steglitz, Berlin, a percentage of 17 per cent, the second largest single cause

(*) J. Missouri M. A., September, 1928.

of blindness. According to Japha, Heine, Mohr and Beck, optic papillitis is uncommonly frequent in luetic infants. Heine found among 60 luetic infants 55 cases of optic neuritis. Igersheimer, who unquestionably is the greatest authority that ever lived on syphilitic ocular changes, and Fehr did not find in their own cases that this change was so frequent in syphilitic infants. John Green found among 100 congenital syphilitic children, between 1 month and 14 years of age, 8 patients with optic neuritis, 6 with bilateral optic atrophy and 2 with unilateral optic atrophy; all the optic atrophy changes were secondary.

Igersheimer thinks it probable that some of those blind from congenital syphilis lose their antibodies in the blood in the course of years and so react negatively to the Wassermann test. He thinks that syphilis plays an important role in blindness from optic atrophy among blind pupils in German institutions for the blind. Many cases reacting negatively to the Wassermann test are probably due to congenital syphilis. The beginning of the process occurs usually in the third or fourth year but not rarely first at puberty and the blindness can occur gradually or very suddenly.

The prevention of juvenile optic atrophy is therefore mainly a matter of intensive antisyphilitic treatment to the parents, principally to the mother.

Injuries of the Orbital Portion of the Optic Nerve. Direct and indirect injuries of the orbital portion of the optic nerve may be produced by (A) Direct injuries: (1) Stab wound. (2) Intra-orbital foreign bodies, such as shot, particles of steel, iron, etc. (3) Operation for the removal of tumors of the nerve or orbit. Or (B) Indirect injuries: (1) Fractures of the skull. (2) Fractures of the orbit. (3) Contusions of the globe. (4) Dislocation of the globe.

In direct injuries the nerve itself is directly traumatized, resulting in complete or partial severance of the nerve stalk and subsequent atrophy.

Indirect injuries may cause atrophy of the nerve following a fracture with impingement of the nerve tissue by the fragments. Blows from a blunt instrument as seen in contusions of the globe cause a rapid and very high intra-ocular pressure and the lamina cribrosa being the weakest region of the globe the optic nerve is pushed into the sheath of the optic nerve which results in atrophy.

Dislocation of the globe from its orbital attachment may result in a complete or incomplete evulsion or separation of the nerve head from its relations with the globe. The optic nerve has no elastic tissue, but the optic sheath is very richly supplied with elastic tissue, it therefore oftentimes dilates and envelops the optic nerve head, giving a very characteristic fundus picture. The retinal arteries and veins may or may not be torn. Atrophy of the optic nerve, resulting in total blindness, is almost always the end-result and makes its appearance usually within two weeks after the injury. D. H. Anthony[5] gives the histories of twelve cases, illustrative of these different forms of injury.

Glaucoma

Non-Operative Treatment of Chronic Glaucoma. Since Posey's paper in 1914 on "The Treatment of Chronic Simple Glaucoma with Mioties" very little has appeared in the literature about the non-surgical treatment of chronic glaucoma until 1923 when Hamburger reported his experiences first with adrenalin and later with glaucosan. The surgical treatment, on the other hand, has received and is constantly obtaining much attention. New operations are being proposed; old ones revived. Probably no one operation will ever meet the requirements of all surgeons.

(5) New Orleans M. & S. J., February, 1928.

The great preponderance of opinion as expressed in the majority of text books and in the discussions of papers relative to the treatment of glaucoma is that some operative procedure will sooner or later become necessary. The earlier in the course of the disease operation is done the greater the likelihood that the results will be beneficial and lasting. At the present time our knowledge of glaucoma and the various operations proposed for its cure does not permit us to say with certainty that operation will cure the disease. Moreover, operative treatment can never be made entirely free from risk. The possibility of infection, both early and late, will always be present to a certain degree. Loss of vision not infrequently results from a marked increase in astigmatism, hemorrhage and the rapid encroachment of a scotoma over the fixation point. Weeks believes that this will occur whatever the operation and perhaps in spite of any treatment. These facts are too well known to need extended discussion.

They serve, however, to emphasize the uncertainty of operative treatment. The proposal of new operations and the reviving of old indicate further not only the dissatisfaction with the available operations but also the failure of medicinal therapy. If non-operative treatment can be shown to be at least as effective as operative its advantages immediately become apparent. A large majority of ophthalmologists have probably observed one or more cases of chronic glaucoma controlled for a long time by medicinal treatment. These are selected cases and as a rule comprise solely those observed outside hospitals and clinics. Zentmayer suggests that miotics may be tried in patients where the tension does not range over thirty and in patients over sixty years of age. Calhoun advocates miotics in three groups of cases of simple glaucoma, (1) patients over 60 years whose life expectancy is not more than 10 years, (2) patients blind in one eye, (3) in those who have lost one eye as the result of operation.

The importance of thoroughly investigating the patient has long been recognized as essential not only for the purpose of diagnosis but also for treatment. In the discussion of a paper by Rowan in 1920 one speaker suggests that whether glaucoma is treated with drops or operation only a symptom is being treated and that if ever a cure is discovered it will be discovered by an internist. Imre's cases treated with glandular extracts and the cases of La Grange and others associated with endocrine disorders lend strong support to this contention and indicate new possibilities. They serve also to emphasize the perhaps too frequently lost-sight-of fact that it is the patient who needs thorough investigation rather than the glaucoma.

Until Hamburger's report in 1923 eserin and pilocarpin have been the chief remedies available for the medicinal treatment of chronic glaucoma. The use of adrenalin and glaucosan appear to be effective means of control in selected cases, some writers going so far as to state that by them operation can frequently be avoided. However, insufficient time has elapsed and use by a large enough number of widely distributed observers is still lacking to permit the estimation of its real value. Moreover, the few unfavorable reports in which elevation of tension has followed its use indicate that the cases must be carefully selected. Where this is done its trial seems more than justified.

S. B. Marlow[6] reports results of miotic treatment in a series of 35 cases of chronic glaucoma. The longest period of observation was fourteen years in one case; the shortest one year; two-thirds have been observed for four years or less.

In all but seven of these cases the miotics have been prescribed according to the formula of Wickerkiewicz which combines Eserin, Pilocarpin and Cocain in the following proportions:

Eserin Sulphat 0.02

(6) New York State J. Med., Feb. 15, 1928.

Pilocarpin Hydrochlorid	0.40
Cocain Hydrochlorid	0.20
Aq. Dest.	20.00

This prescription has as a rule been used only twice daily. In no case have iris adhesions become apparent and cases of toxic conjunctivitis have been exceptional. The impression gained from the extensive use of this combination is that it is more efficient and less annoying to the patient than either eserin or pilocarpin alone.

In order to discuss intelligently the treatment of chronic glaucoma the two forms in which this condition occurs must first be recognized. The distinction between chronic inflammatory glaucoma and simple glaucoma is so well known that no elaboration is necessary. It does seem worth while, however, to restate Schweigger's view that chronic inflammatory glaucoma is dormant potential acute inflammatory glaucoma. It is for this reason that operation is almost universally considered to be necessary early in this type of the disease.

In nearly two-thirds the age at onset was 50 or more. It was under 50 in 5 cases of the chronic inflammatory type, over 50 in 6; of the simple cases 8 were under 50, 16 over 50. This suggests a more even distribution for the chronic inflammatory cases and a great preponderance of the simple at a greater age. Ten patients were blind in one eye when first seen. Six of these were under 50 at the age of onset, 4 over. Two of three chronic inflammatory, four of seven simple cases which were blind in one eye were under 50 at the onset of the disease. Seven cases came to operation, three were under 50 at the age of onset. These facts seem to indicate that no matter what the type of the disease the younger the patient the more devastating its effects. Although the teaching that conservative treatment should be used only in cases over 60 receives some sup-

port, its use in much younger patients appears beneficial for long periods of time in both types.

Analysis of 11 cases of chronic inflammatory glaucoma results in the following: Four were in the advanced stage of the disease when first seen. Only one was favorably influenced by miotic treatment. This patient was also the only one under fifty at the age of onset and had been observed for five years at the end of which time vision was better than at the original examination. One patient refused operation, miotics maintaining vision for one year. One patient was successfully operated on so far as tension was concerned but with no influence upon vision. Thus miotic treatment was advantageous in one case only.

The seven early cases had their age at onset of 35, 42, 36, 50, 52, 64 and 45 years. Four subsequently came to operation. One was operated on elsewhere in spite of the fact that miotics had improved and maintained the vision and tension for more than one year. One developed an acute attack after 6 years necessitating iridectomy with good results. In one, iridectomy failed to check the loss of vision. In the three cases not operated on the vision was maintained for 15, 2 and 1 years. From this the conclusion may be drawn that the advanced cases of chronic inflammatory glaucoma in this series progressed unfavorably in the majority of cases in spite of treatment operative or otherwise. In the early cases operation benefited 2, and had no effect in one, the effect of operation in one being unknown. On the other hand three cases were favorably influenced, one for a considerable period of time. Therefore, it seems justified to state that miotics, in some cases at least, are capable of controlling the progress of the disease and that their use for a long time does not necessarily preclude good results from eventual operation. It also appears true that the younger the patient the more likely is operation to become necessary.

Twenty-four cases of simple glaucoma are summarized. Ten were in an advanced stage of the disease when they were first seen. In one case iridectomy was done on one eye with apparent arrest of progressive change, the unoperated eye remaining under miotic treatment. In two, consultants advised against operation. Miotics maintained or improved vision in five cases including one in which operation was considered inadvisable. Five cases failed in spite of treatment. The more rapid failure took place in the older patients. The rate of change was slow in each case, one of which was operated on. These cases seem to indicate that older patients with advanced disease respond less rapidly to miotic than younger.

Miotics are, however, advantageous in advanced cases, only two cases of this series becoming seriously handicapped while under observation. Of fourteen early cases the vision of five at the last examination was less than at the first. One case was operated on after nine years of observation. This was a case of high myopia in which vision continued to fail and the field to contract in spite of the fact that miotics kept the tension at a normal level. A LaGrange operation was successful in bringing the tension to a normal level but failed to check the advancement of a scotoma and further loss of vision. In two the visual loss was accounted for by the development of lens changes. In another advanced cardio-renal disease with retinal changes was an unfavorable underlying factor. In the last the vision had fallen from 6/6 to 6/9 after 6 years due to the glaucoma although the tension was not greatly elevated. In this case a consultant advised operation. The remaining nine cases maintained the vision of the first examination so that miotics apparently checked the progress of the disease.

Thus with two exceptions all the early cases did well no matter what the age at onset. While operation may eventually become necessary in some of the younger pa-

tients this is less likely to occur in older patients. The teaching that patients of 60 years or over can be safely treated with miotics gains some support from those cases. They further suggest that the value of this treatment is not limited to patients of this age and that not a few cases can be carried along safely for a considerable period if they are carefully watched.

In 1901 deSchweinitz advocated iridectomy on the second eye at the earliest possible moment in all cases of acute and chronic inflammatory, and simple glaucoma if any signs of the disease could be demonstrated. The general trend of the discussion supported his opinion. In 1920 in the discussion of the paper of Rowan., already referred to, a less radical attitude was manifest although some further support of this opinion is offered. It is interesting in this connection to note the results of non-operative treatment in the patients in this series who were blind in one eye when first examined.

Two cases failed rather rapidly and one developed an acute attack. In the case that failed from 6/6 to 6/12 after four years a consultant advised against operation. The remaining cases had as good or better vision at the last examination than at the first. They would seem to support Calhoun's suggestion that patients with one blind eye should be treated with miotics. The fact that one eye is blind may be contributory to the good results obtained for two reasons. First: being blind in one eye the diagnosis is made earlier in the second. Second: having but one eye the patient is correspondingly concerned and takes better care of this eye.

Although the treatment appears to have maintained the vision in the majority of these cases during the period of observation it has been less effective in arresting the contraction of the field of vision. In only one case was the field of vision larger at the last examination than at the first. In many of the early cases the progressive contraction of the field appear slowed. In two

cases which had normal periphery but typical scotomata the scotomata remained stationary under observation. In one case observed for nine years before operation while the tension and central vision were maintained the field progressively changed. Operation in this case while successful in reducing the tension did not check the advance of the field changes. In the advanced cases treatment seemed to have much less effect.

The intra-ocular tension was kept within normal limits in 8 chronic inflammatory cases and 16 simple cases. Three chronic inflammatory cases were operated on with a good result. Two others were operated on without checking the progress of the disease. One of these was in an advanced stage, the other in an early stage of the disease. In four of eight cases of simple glaucoma in which the tension was not controlled by mioties the vision improved in one eye. One maintained the vision of the first examination for little over a year although tension was considerably above the normal. Two failed and may have been operated on elsewhere. One had rather marked arterial disease. All but one were advanced cases. The one early case was the case with arterial disease. This constitutes on the whole a favorable showing for the treatment employed. It further indicates that increased tension is only a part of the disease process.

Although this series of cases is too small to allow the drawing of general conclusions, they seem to suggest that nonsurgical treatment is justified in a large number of cases. They also emphasize what is already generally accepted, that treatment, surgical or medical, is more likely to be successful when supplemented by careful and thorough investigation of the patient.

Since 1922 Axeliades[7] has treated twenty-four individuals suffering from *absolute glaucoma* by the method of retrobulbar injections of alcohol to relieve pain. The case histories of eleven individuals are given. In one

(7) Arch. d' opht., March, 1928.

group the injections were made merely to relieve pain while substantiating a diagnosis of intra-ocular tumor, and in the other the relief of pain was desired to precede posterior sclerectomy to relieve tension. In all cases the eyes were blind or had merely light perception.

The technic was to inject one c. c. of alcohol and one c. c. of 4 per cent novocain in the manner used for injecting the ciliary ganglion. The relief of pain occurred within one-half hour. In some cases it was necessary to repeat the injection within a week but never more than three were necessary. The corneal sensibility was diminished but there was no neuroparalytic keratitis. Some extra-ocular muscle paralyses occurred but they cleared up within a month. Those patients with light perception retained it after the injection, as the alcohol did not affect the optic nerve. The tension remained the same after injection. To relieve this a posterior sclerectomy with the Elliot trephine or a Graefe knife was done about fifteen to twenty-five days after injection. Two of these patients had to be reoperated. The important features were the immediate relief of pain and the preservation of the globe.

The Action of Adrenalin in Glaucoma. M. Vannas[8] has studied the action of adrenalin in glaucoma, and gives us a comprehensive survey of the subject. Sixty-one glaucomatous eyes in fifty-one individuals were studied, following injection of 0.2-0.5 c. c. adrenalin subconjunctivally and readings made with the Schiötz tonometer. Thirty-six eyes reacted with a fall of pressure, averaging 18 mm., 11 showed an average increase of pressure of 11 mm., while in 14 no change occurred. In 25 eyes with tension 28 to 60 mm. the pressure was normalized. With pressure not higher than 40 mm., 21 to 31 eyes were reduced to normal tension, but pressure above 40 mm. was rarely brought down to normal. Pressure began to fall in most cases within one hour, but occasionally not until the second day, and the fall

(8) Acta ophth., v. 4, 1927.

was gradual, reaching the minimum usually during the first day. In ten days a slight increase (3-10 mm.) was noted before the decrease occurred. The lower tension continued an average of one to four days, in one case twelve days. When increased tension occurred it was within the first three hours.

The second and constant action of adrenalin was dilatation of the pupil, occurring within three to six minutes, and lasting six to twelve hours. The fall in pressure usually occurred after dilatation of the pupil began to subside.

The best results occurred in glaucoma simplex, 26 to 34 eyes, while the poorest results were noted in inflammatory glaucoma. The results in secondary glaucoma varied greatly. The comparison of adrenalin and the miotics showed that the fall in pressure occurred in just the same cases and adrenalin therapy afforded no definite improvements over miotics. In other than glaucomatous eyes only a slight transitory fall in pressure occurred. The mechanism of the action of adrenalin is probably the direct or indirect effect of pupillary dilatation. The fall of pressure occurs through the effect upon the uveal vessels.

In many cases the blood pressure was increased following the subconjunctival injection but the writer questions if this is not due as much to pain, psychic influence, etc., as to the adrenalin.

Ocular Tuberculosis

Differential Diagnosis in Tuberculosis of the Eye. When Michel, in 1890, emphasized the significance of tuberculosis as an etiologic factor in diseases of the eye, he was literally ridiculed by his colleagues. Since then there has been a marked change of opinion, and, at the present time, it is well known that any tissue of the eye may become the seat of a tuberculous process.

Histologic evidence that has been gathered from the study of microscopic sections of eyes has proved that tuberculosis is frequently responsible for ocular inflammations. Research workers have also been able to produce in animals all the clinical manifestations of tuberculosis of the eye as it is seen in the human being, and have fully substantiated Michel's contention.

In many instances, obscure inflammations of the eye are of tuberculous origin, and they may tax one's resources to the utmost in making a diagnosis, and unless one has tuberculosis in mind, the cause may be overlooked. W. C. Finoff[9] makes the following valuable contribution to the literature of the subject:

With the exception of involvement of the conjunctiva and the cornea, and following perforating injuries, it is secondary to a focus elsewhere in the body. In the majority of cases, the primary focus is relatively inactive, and it is often impossible to locate it with our present methods of examination. The idea that prevails in some minds, that an active lesion must exist in the lungs before the eye can be involved, is erroneous. In the author's pathologic collection there are several eyes that show typical tuberculosis that were removed from persons in whom no physical signs or roentgen-ray evidence of the disease could be found elsewhere. It is for this reason that one must frequently rely on the clinical picture as it is manifested in the eye in order to make the diagnosis.

The general characteristics of uncontaminated tuberculosis in most tissues are chronicity, freedom from pain, and the tendency to produce yellowish avascular tubercles that break down into ulcers. The histologic structure of the invaded tissue determines the morphology of the lesion and its clinical appearance. For this reason, it is quite obvious that the clinical picture will differ with involvement of the various portions of the eye.

(9) J. A. M. A., Feb. 4, 1928.

The orbit.—Tuberculosis of the orbit offers many difficulties in diagnosis. The temporal margin and the zygoma are the most frequent sites. In the early stage there is marked induration and swelling over the rim of the orbit. Later, the abscess ruptures through the skin and leaves a characteristic fistulous opening. On probing, denuded and roughened bone is felt. Guinea-pigs inoculated with secretion taken from the fistula die from tuberculosis if that is the cause. It may be confused with syphilitic or other forms of osteomyelitis or periostitis in this region. Fistulous openings are not characteristic of syphilis.

The ulcerative type is almost always confined to the primary lesion, and *Spirochaeta pallida* can easily be found in scrapings from the chancre. Secondary manifestations are exceedingly rare. Occasionally, a gumma becomes necrotic and leaves an ulcer. When this occurs the Wassermann reaction is positive, antisyphilitic treatment causes rapid improvement, and the diagnosis is thus established.

Multiple fistulas are characteristic of actinomycosis. Sulphur-like granules, which contain the ray fungus, are found in the secretion that escapes from them.

The conjunctiva and lids.—Tuberculosis of the conjunctiva should offer little difficulty in differential diagnosis because of its characteristic clinical picture. It occurs in young persons; the course is essentially chronic, running over a period of months or even years; the patient does not complain of pain, and it is usually unilateral. The lid is thickened, and the preauricular lymph gland, and often the submaxillary and cervical glands, are enlarged on the affected side. When the eyelid is everted, a characteristic irregular, dirty gray ulcer, with scattered red loops of granulation protruding through the necrotic material in its base, is seen. The ulcer has a punched out, mouse-eaten border, and the surrounding conjunctiva and tarsus are often a lardy, yellowish red. The progress is slow, and the ulcer shows

little disposition to heal. In advanced cases, the bulbar conjunctiva and cornea may be invaded, and the ulcer, which is usually confined to the tarsus, may perforate into the subcutaneous tissue or through the skin.

A positive diagnosis can be made easily by removing some of the tissue and introducing it into the peritoneal cavity of a guinea-pig, or by sectioning the tissue and staining for tubercle bacilli. The former is the most satisfactory method because of the difficulty and uncertainty in finding bacilli in tissues.

Parinaud's conjunctivitis presents a clinical picture that may be confused with tuberculosis. Parinaud's disease, however, is much more severe, and is ushered in with fever and other constitutional symptoms. Verhoeff described a filamentous leptothrix as the cause. This has not been confirmed by other observers, because —according to Verhoeff—of faulty technic in staining.

The ulcers of the conjunctiva described by Pascheff are usually multiple and are present in both lids. The condition is also accompanied by constitutional symptoms. Tularensis, or the so-called squirrel plague conjunctivitis, has symptoms similar to Pascheff's disease. A specific bacillus has been described as the cause. Its association with contaminated squirrel can usually be traced.

Blastomycosis and sporotrichosis have characteristic symptoms and typical micro-organisms, and, for this reason, should not be confused with tuberculosis.

Tuberculosis of the bulbar conjunctiva or of the fornices is rare. It is usually seen as a nodular swelling that varies in size from a millet seed to a pea. This nodule is yellow and may be multiple. Sections of tissue and animal inoculation are useful aids in diagnosis.

Lupus of the skin of the eyelids and conjunctiva is exceedingly rare in this country. It is quite prevalent in some parts of Europe. If encountered in the skin of the lids, nearly all the forms known to the derma-

tologist may be observed. It is usually secondary, extending to the lids from areas in the face. The diagnosis is usually made before the patient consults the ophthalmologist.

The lacrimal apparatus.—Tuberculosis of the lacrimal sac, according to Stock, occurs rather frequently. The diagnosis can be made only by histologic examination after operation. It is secondary to tuberculosis of the lid or nose in practically all instances.

The cornea.—Tuberculosis of the cornea is usually associated with tuberculosis of the uveal tract or sclera. It rarely involves the cornea alone. It usually occurs as a parenchymatous keratitis. Uhthoff found it in seven out of 163 cases in which he could determine the etiology of the keratitis. The appearance of the cornea in tuberculosis does not differ from that in syphilis because the histologic changes are much the same. The diagnosis hinges on the result that is obtained when tuberculin is used as a diagnostic or therapeutic agent.

Sclerosing keratitis is usually associated with chronic scleritis. If it occurs in young persons, it is often due to tuberculosis. The scleral involvement is the more conspicuous during the active process, and the corneal changes are a secondary manifestation. If it begins in older persons, the cause is usually something other than tuberculosis.

Episclera and sclera.—Many observers assert that an overwhelming majority of the cases of episcleritis and scleritis are due to tuberculosis. This is questionable. When it occurs in young persons and is extremely chronic in nature, associated with the formation of tubercles in the conjunctiva or episcleral tissue, it is almost certainly due to tuberculosis. In these cases tissue can be removed for biopsy or for injection into guinea-pigs, after which a positive diagnosis can be made.

In the recurring cases of diffuse episcleritis or scleritis, it is extremely difficult to make a differential diag-

nosis, and the etiology in many cases can never be found. The diagnosis must be made by exclusion. Tuberculin may be of some assistance, but its influence on the course of the disease is usually disappointing. While corneal involvement is of more frequent occurrence with tuberculosis of the sclera, still it is manifest in other forms of scleritis.

The iris.—Tuberculosis of the iris has a characteristic picture when it occurs in the nodular form. It must be differentiated from syphilis, sympathetic ophthalmia, ophthalmia nodosa, and malignant tumors. Miliary tubercles arise simultaneously in the iris in different locations. All zones, i. e., the base, middle zone and pupillary area, may be involved. The nodules usually resemble millet seed, and the blood vessels of the surrounding stroma are congested. In syphilis, only the basal and pupillary zones are affected. In tuberculosis, the nodules are more yellow than in spyhilis, when they are more likely to have a pinkish hue. In the latter disease, marked improvement follows the administration of one of the arsenicals, mercury and iodides, and the Wassermann reaction is positive in a great majority of cases.

Sympathetic ophthalmia may exactly simulate the picture of tuberculosis, and the history will be the key to the differential diagnosis. Without a history of injury to the eye, a differential diagnosis cannot be made because, with the exception of caseation and the presence of tubercle bacilli, the microscopic changes of the two conditions are exactly the same.

Large solitary tubercles may be confused with a gumma or malignant tumor. Tubercles of this type are usually yellow. The lesions are avascular, but blood vessels may pass over their surface. Gummas are more red and improve under antisyphilitic therapy. Malignant tumors are pigmented and are vascular and do not show any tendency toward improvement under hygienic measures and tuberculin. In children, exu-

berant growths on the surface of the iris or in the angle of the anterior chamber are sometimes seen in cases of retinoblastoma (glioma of the retina), and must not cause confusion. Their structure and color closely resemble tubercles.

Ophthalmia nodosa is exceedingly rare, and a caterpillar hair can usually be seen in the center of the nodule with a loupe or with the corneal microscope and slit lamp.

There is a form of chronic iridocyclitis, not accompanied by tuberculous nodules, which is due to tuberculosis. It is characterized by the usual symptoms of a severe chronic iritis due to other cause, in addition to large lardaceous (mutton fat) deposits on the posterior surface of the cornea. The whole of the posterior aspect of the cornea may be covered by them and the vision greatly reduced. The deposits are unpigmented and may vary in size. When the iris is visible, small gray nodules may be discovered at the pupillary margin with the corneal microscope. Koeppe believes that their presence is indicative of tuberculosis. They leave fine strands of connective tissue that run from the margin of the pupil to the anterior lens capsule and form firm posterior synechiae. Secondary cataract is a frequent accompaniment of this form of the disease. If yellow corneal infiltrates occur during the inflammation, the disease is almost certainly of tuberculous origin.

The choroid.—The active stage of a disseminated choroiditis is frequently located in the periphery of the eye and does not produce visual disturbance unless there is extension into the macular region. When studied with the ophthalmoscope one sees diffuse, irregular, grayish-yellow infiltrates, which have the appearance of washed edges. The vitreous is usually slightly turbid, although this feature is not so pronounced as it is in syphilis. This stage does not last long, and the picture soon changes to one of irregular, white patches of scar tissue that are bordered with pigment. The tuberculous

form is usually more diffuse and irregular than other types of choroidal inflammations, although there are sometimes exceptions to this rule. Some writers assert that the only positive diagnostic sign is a focal reaction to tuberculin. In any event, it is difficult to make a diagnosis of tuberculosis in this variety of choroiditis.

Miliary tubercles of the choroid almost invariably occur at the terminal stage of a systemic tuberculosis. They are easily seen as slightly elevated, isolated, yellowish masses under the retinal vessels. Pigment changes do not occur until after the fourteenth day in the patients who live for that length of time. The accompanying active, general miliary tuberculosis makes the etiology clear.

The retina.—Retinal tuberculosis may be secondary to a choroidal process, or it may develop independently of demonstrable lesions in the uveal tract. Three types occur most commonly; viz., small miliary tubercles, conglobate, and tuberculosis of the retinal blood vessels.

The small miliary tubercles are seen most often in the macular region, and may be confused with the exudates of renal or other forms of retinitis. The latter can usually be eliminated by a general physical examination. The fundus lesions are more circumscribed than in renal and other forms of retinitis, and are located in the middle layers in the region of the finer retinal blood vessels. Solitary or conglobate tubercles may easily be mistaken for malignant tumors. The tubercle contains less pigment than most tumors. It is distinctly yellow and is usually surrounded by a halo of edema in the early stage and by pigment later. A focal reaction to tuberculin usually occurs. Frequently, anterior uveitis with deposits on the posterior surface of the cornea occurs early in the disease and suggests its inflammatory nature.

Retinal periphlebitis, especially when associated with recurrent hemorrhages into the retina and vitreous, was described by Axenfeld and Stock as a characteristic

tuberculous condition. It is probable that many of the cases are due to it. After a careful study of thirty-four cases, over a period of years, the author has come to the conclusion that not all cases of recurrent hemorrhage into the retina and vitreous of young persons are due to tuberculosis. He believes that those with yellowish and gray exudates into the perivascular lymph spaces, especially of the veins, are tuberculous in character. In these cases, the exudates are first seen in the extreme periphery of the fundus and later appear in the posterior quadrant. They are seen most frequently where the lymph flow is retarded; i. e., at the points of crossing of the arteries over the veins and at the bifurcations of the veins. Recurrent hemorrhages without the exudates that have just been mentioned are not characteristic of tuberculosis and may be due to other causes. After 35 years of age, recurrent hemorrhages are usually due to some structural defect in the retinal vessels that result from renal or other disease.

The optic nerve.—A tumor-like mass of yellow or yellowish-gray color on the papilla, either with or without blood vessels passing over its surface, is usually a tubercle. As sarcomas and other tumors are rare in this location, they can be excluded easily. In the early stage it may be difficult to differentiate them from papilledema. The yellowish color and nodular form are differential points. If the retrobulbar portion is involved, the spinal fluid may contain tubercle bacilli. Fortunately, tuberculosis of the optic nerve is extremely rare.

The value of tuberculin in diagnosis.—Most of us can remember when tuberculin was considered a specific diagnostic agent for tuberculosis of the eye. It was believed and taught that, if a focal reaction occurred at the site of a lesion, after the injection of tuberculin, it was positive proof that the lesion was tuberculous. Since A. Lowenstein, in 1918, observed severe local reactions after injecting milk, and Tobias, in 1922,

found that pollen and casein gave focal reactions in tuberculous eyes, this faith in the specificity of tuberculin has been shaken somewhat. With their experiments in mind, it is reasonable to suppose that lesions other than tuberculosis may react in a similar manner to the foreign protein tuberculin. Further observation and research are needed to clarify this important question. If tuberculin does not produce a specific reaction, it is of little value as a diagnostic agent. As to its value in treatment, it matters little, excepting from a purely scientific standpoint, whether the action is specific or not. It causes improvement in tuberculous lesions, and for that reason its use should be continued regardless of whether it acts as a foreign protein or stimulates the body to the production of specific antibodies.

Great importance is attached to focal reactions—reactions in the lesions of the eye. We are taught that if, after the injection of tuberculin, a lesion in the eye becomes definitely more hyperemic, increasing in size, and an increase in the number of exudates and hemorrhages occurs, a focal reaction has taken place. Local reactions that occur at the site of the injection are of no value in diagnosticating ocular tuberculosis. All that they suggest is that the individual has been rendered sensitive to the agent because of active or latent tuberculosis in some part of the body. A constitutional reaction has the same significance and proves little in regard to the eye. The Pirquet and intradermal reactions are of little value for the same reason.

A word of caution regarding the use of diagnostic tuberculin will be timely at this juncture. Tuberculin should never be used for diagnostic or therapeutic purposes until a thorough general physical examination has been made by a competent internist to determine whether active tuberculosis is present in some portion of the body.

It should always be borne in mind that under certain conditions tuberculin is an exceedingly dangerous drug.

If it is injudiciously administered in cases of active tuberculosis, it might so aggravate the disease that marked dissemination would occur or a fatal issue result. For this reason, the patient's general condition should be carefully investigated by one who is thoroughly familiar with tuberculosis of the lungs and other parts of the body. If, after examination, the internist pronounces the patient free from clinical signs of tuberculosis, the ophthalmologist is justified in assuming the responsibility of the case and administering tuberculin. It is prudent, however, to have the patient examined from time to time, to be certain that no latent focus has been excited into renewed activity.

If active tuberculosis in the lungs or elsewhere is found, the ophthalmologist should require that the internist supervise the administration of the tuberculin. He should then satisfy himself with the observation and study of the ocular lesions. The determination of ocular reactions should be undertaken by the ophthalmologist.

The appearance of focal reaction differs somewhat with the location of the ocular lesion. In keratitis, the reaction manifests itself by an increased cloudiness of the cornea, diminution in visual acuity, increase in the circumcorneal injection, lacrimation, photophobia and pain.

In scleritis, an increased congestion, induration and aggravation of subjective symptoms occur.

A reaction in iris tuberculosis would depend on the type of iritis. In diffuse tuberculous iritis, the circumcorneal injection is aggravated; the aqueous becomes more cloudy and the precipitates on the posterior surface of the cornea increase in number; the iris becomes more swollen; the vessels, when visible, become more engorged, and the pupil contracts. In addition to this, the subjective symptoms become aggravated. In the nodular type, the greatest change is in the size of the nodule and in the injection of the blood vessels that

approach it. Circumcorneal injection and the other accompanying symptoms become aggravated also.

The ciliary body reacts in much the same manner as the iris. Visual acuity is often more disturbed than in cases of iritis, and secondary glaucoma is not an unusual accompaniment of the reaction.

Reactions in the retina and choroid are easily detected, provided the media are relatively clear. In the retina, reactions may be hazardous and may result in marked loss of vision or extensive hemorrhage. The visual loss may be permanent, and the hemorrhages are frequently replaced by dense bands of scar tissue in the vitreous and retina. Haziness of the vitreous and increase in the number and size of exudates are frequently seen.

Choroidal reactions are manifested by increased haziness of the vitreous, by increase in the size of the tubercle, and occasionally by detachment of the retina due to a sudden pouring out of exudate between the choroid and retina. Loss of visual acuity is also a prominent symptom.

Reactions in the optic nerve are manifested by increased haziness of the vitreous, increase in the size of the tubercle, and an aggravation of the hyperemia of the disk. In addition to these symptoms, the vision is diminished if it has not been destroyed previous to the time of the diagnostic test.

Old tuberculin, O. T., is preferred by most ophthalmologists for diagnostic purposes. There is some difference of opinion, however, regarding the size of the dose and the interval of time that should elapse between injections. Probably one of the reasons for the marked difference in opinion regarding the latter has been the failure to classify the cases and regulate the dose to the individual. The dose of tuberculin should vary in accordance with the type and character of the lesion. Doses that produce harmless reactions in the sclera would be fatal to the integrity of vision in tuberculosis

of the retinal blood vessels. In certain types of retinal lesions, one should be content with a clinical diagnosis and not subject his patient to the danger of serious loss of vision.

The eye is an ideal location in which to study the effects of tuberculin on minute tuberculous foci, and the ophthalmologist is in a position to aid in either verifying or refuting the claims that have been made for tuberculin. By a systematic study and reporting of their observations in proved cases of tuberculosis, ophthalmologists should do much toward placing tuberculin on a scientific instead of a conjectural basis.

With regard to the *gold treatment of tuberculous eye affections,* E. Stoewer[1] reports six cases that were treated with krysolgan (Schering) and tryphal (Farbwerken Höchst a. M.), beginning with injections of 0.1 increasing gradually up to 0.025, and finally 0.05. Cases with general tuberculosis of the glands and those in which a preceding tuberculin cure did not have the desired effect are adapted for treatment with gold. Where tuberculin is effectual, gold preparations are not needed. For some resistant cases surprising results may be obtained.

According to Edward Asmus[2], *tebeprotein* deserves a prominent place in the treatment of ocular tuberculosis. This preparation, he states, is ten times less poisonous than old tuberculin and its reaction is one hundred times more sensitive. The initial dose is 1/10 mg. in 1 c. c. solution No. 1. The solution remains good for a year. Out of twenty cases, seventeen, i. e., 75 per cent, were cured; one was improved; one remained on a good level; one was not influenced.

First-Aid Treatment of Ocular Injuries. Eye injuries are often seen first by the general practitioner. In advising the physician how to handle such cases, S.

(1) Klin. Monatsbl. f. Augenh., March, 1928.
(2) Ibid.

Kirkpatrick[3] has outlined a series of excellent *"Don'ts."*

Don't attempt any work on the eye without good light and proper magnification. Many young physicians, and all of those nearing presbyopia, which usually begins about the age of 40, require a magnifying glass to see small particles of foreign bodies and abrasions in the eye. The inability to see these small lesions is the cause of many failures properly to diagnose and treat them. A good flashlight and a pocket magnifying lens, to be had at almost any jewelry store, will serve the purpose very well in the absence of electric lights and a Berger loupe. In the preliminary examination a careful search should be made of every part of the eye, field by field, as one uses the microscope.

Don't attempt to remove a foreign body without seeing it. Many physicians are guilty of the universal habit among the laymen of trying to remove a foreign body, or an imaginary foreign body, from the eye with a cotton-wrapped match or tooth-pick without first locating it. This is reprehensible and potentially dangerous. It breaks the epithelium and opens up avenues of infection.

Don't fail to cleanse the eye well with warm boric acid solution and drop in a 2 per cent solution of mercurochrome before attempting any surgical procedure.

Don't neglect to sterilize all instruments and solutions which come in contact with the eye. Approach the situation with the same thoroughness that one uses in major operations. The sterilization can best be effected by boiling, but when away from the office or when this is impossible, immersion in alcohol 95 per cent or a 10 per cent lysol solution for about 10 minutes has proved very satisfactory; but this method of sterilization is not absolute and should not be relied upon in penetrating wounds of the eyeball. By far, the greatest percentage of emergency cases we are

(3) Surg. J., January-February, 1928.

called upon to treat consist of foreign bodies and abrasions of the cornea.

Don't forget that a slight abrasion of the cornea gives all the symptoms of a foreign body, and that these abrasions will take the mercurochrome stain and enable you to differentiate a foreign body from a simple abrasion.

Don't treat a slight abrasion of the cornea lightly. Regard all injuries as infected and treat them as such.

Don't scrape the cornea in the attempt to remove an imbedded foreign body, but lift it out by a teasing motion with the point of a cataract knife or some other sharp-pointed instrument. The epithelium should not be removed over an area greater than that occupied by the foreign body. The only exception to this rule is when the foreign body has remained in the eye some time and infection started as evidenced by a white ring or halo surrounding the foreign body. This halo is usually undermined and consists of a ledge of epithelium with the infection creeping along the lymphatics underneath. It should be curetted away so that antiseptics may come in contact with the infectious area.

Don't neglect to remove the rust stain deposited by chemical action on metallic foreign bodies and emery particles of long residence in the cornea. This brick-dust stain is as irritating to the sensitive structure of the eye as the foreign body itself and decidedly more difficult to remove.

Don't neglect to approximate very carefully the cut edges of all incised or lacerated wounds of the lids and surrounding skin. Failure to do this results in distortion and deformities of which you may be ashamed, the patient dissatisfied and probably result in a lawsuit for damages against you or the company you represent.

Don't neglect to note the size and shape of the pupils, their reaction to light and accommodation, the depth of anterior chamber, and whether it contains blood. A tremulous iris denotes a dislocated lens.

Don't forget to test the vision of both eyes. The uninjured eye may have defective vision, the knowledge of which would save you embarrassment in the event of a lawsuit, and is of importance in checking up the progress of the treatment and further developments.

Don't use cocain at all. A 1 per cent holocain or a 2 per cent butyn are just as efficient local anesthetics and free from the objections to cocain. Cocain, like atropin, may precipitate an attack of glaucoma in a predisposed eye and its frequent or continuous use causes a desquamation of the corneal epithelium—retards the reparative processes. Holocain and butyn can be sterilized by boiling, keep well and do not interfere with healing.

Don't use atropin in an eye that has sustained an injury from a blunt agent like the fist, block of wood, metal or ball, if the pupil is dilated.

Don't use atropin in the eyes of patients above 40 years of age without consultation with an eye man. You are apt to cause glaucoma. Atropin is a double-edged sword, necessary and dangerous, and one which requires discriminating judgment.

Don't drop any medicine into the eye without first reading the label on the bottle. If this rule is adhered to, iodin would never be used for argyrol, etc.

Don't forget that ice compresses are the very best first-aid application to the eye whenever it is possible to get them.

Don't bandage an eye which contains pus. Drainage is as necessary to the eye as it is elsewhere in the body. But, fortunately, pus cases are seldom seen in first-aid work on the eye, only in dacryocystitis or in an eye previously infected.

Don't fail to put an injured eye at rest and take the patient off the job until you are assured there will be no violent reaction.

Don't give a favorable prognosis of any eye injury at the first visit.

Don't forget that a sliver of steel or a sharp-pointed missile may enter the interior of the globe, leaving no visible opening, due to swelling of tissue and its presence not known until followed later by serious reactions.

Don't attempt to treat perforated wounds of the eyeball if possible to refer them to an oculist. Equally blameworthy is the practitioner who openly avows no knowledge of eye diseases and regards the subject as one does the Einstein theory, and the surgeon who does not know his limitations and attempts to operate on all pathologic conditions in any part of the body. No physician ever lost prestige with his patients by referring them to the proper source for maximum benefit. Should you find it necessary to treat the penetrating wounds of the globe, see that all foreign bodies are removed, trim off all tags of prolapsed iris or loose torn tissue that will act as drains to the interior of the eye, and carefully coapt all gaping wounds with fine sutures.

Don't forget that all wounds involving the corneoscleral junction are prone to cause sympathetic ophthalmia in the fellow eye and total blindness.

Don't permit a one-eyed man to work around machinery. He has a limited field of vision and a loss of the depth and spacial senses and cannot properly care for himself in dangerous situations.

Don't fail to record in ink all findings in eye injuries.

Ocular Therapeutics

Protein Therapy in Ophthalmology. In the treatment of inflammatory diseases of the eye, the injection of foreign protein intramuscularly, subcutaneously or intravenously has been established as an efficient and relatively safe procedure. The generally accepted indications for its use are (1) acute or subacute local infections about the eye, (2) chronic constitutional or

systemic diseases with secondary inflammation in the eye or adnexa, and (3) prophylaxis. The dangers of its use and the contraindications are probably not so well understood or so generally agreed upon.

The kind of protein to be used, and the amount and the frequency of administration, are questions on which there are differences of opinion among clinicians, but it is hoped that they may be settled by many well-controlled observations. The administration of pharmacologic agents in combination with proteins introduces a complicating factor, and the way in which proteins act under such conditions is not quite clear; clinicians are convinced, however, that the combined treatment is effective and satisfactory in certain conditions, and its field of usefulness is rapidly widening.

Anaphylactic shock or severe reactions seldom occur if the proper dosage of proteins is observed. Tests for protein sensitization can usually be carried out before the injections are given. The best results from protein injections are obtained if a moderate rise in temperature (101 to 103°) and mild leukocytosis (12,000 to 18,000 cells) follow in from six to twelve hours and disappear before twenty-four hours. The rarity of severe reactions following the wide clinical use of serums, milk, vaccines, and other biologic preparations is the best evidence of the safety of the treatment. With the precautions that can be taken, the danger of anaphylaxis or severe and undesirable reaction is reduced to a minimum.

W. L. Benedict[4] gives the indications for the use of (1) specific protein, (2) nonspecific protein, and (3) combined protein and pharmacologic agents.

Specific protein is employed in the treatment of infections about the eye caused by a known agent for which a specific vaccine or other biologic preparation is available. The list of specific proteins is not large, but includes tetanus antitoxin, diphtheria antitoxin, auto-

(4) Minnesota Med., April, 1928

genous vaccines, tuberculin, and others less commonly used. The indications for their use are quite definite and the amounts to be given have been determined for standardized preparations. Many of the specific proteins are used as nonspecific protein because of the ease with which they may be obtained; while the dosage is no different, the results obtained are not so decisive. Autogenous vaccines, prepared under conditions that make it certain that the infecting organism responsible for the disease is used, are most efficacious in the treatment of acute local infections and provide relative immunity as well. Styes, chalazions, and corneal ulcers react most favorably to autogenous vaccines, while chronic conjunctivitis, blepharitis, and eczematous dermatitis are less favorably affected. Autogenous vaccines are used in the treatment of diseases of the eye due to focal infection. Such diseases usually do not produce pus and are not accompanied by a noticeable systemic reaction. The vaccines are prepared from organisms obtained from foci about the teeth, tonsils, or genital organs, after passage through animals has shown which of the many organisms obtained may be considered pathogenic. Rosenow has demonstrated that some form of streptococcus is most frequently found in foci causing metastatic diseases of the eye. Clinical experience with vaccines made from the streptococci, proved by his method to be pathogenic, shows conclusively the value of specific vaccines.

Infections by organisms for which no specific antitoxin is available should be treated as systemic diseases with nonspecific protein. Organisms which give characteristic blood tests, such as *Bacillus tularense,* may produce pronounced general disturbances and severe ocular inflammation, but as yet no specific remedy has been prepared. Local infections are commonly caused by cocci or mixed organisms which are of low virulence and produce no systemic change. If the infection is acute, such as serpiginous ulcer of the cornea, there is

little difference in the results after the injection of diphtheria antitoxin, milk, typhoid vaccine, horse serum, or the serum of man. The systemic reaction to any of these proteins brings about a change in the healing of the ulcer. Chronic infections of the lids, cornea, or uveal tract, however, respond more readily and more satisfactorily to milk, but in some instances, when milk has not brought about the desired change in healing, better results can be obtained by the administration of some other protein. The continued use of one form of protein is often not so effective as the substitution of another. For instance, after four injections of 10 c. c. of milk no further beneficial effects can be obtained by its use, but some other protein, such as diphtheria antitoxin, will bring about a new stimulation of healing. In other words, after one form of protein is no longer effective, another form can be administered which will be as effective as the first dose of the previous protein. This is illustrated by the effectiveness of autogenous or stock vaccines in certain chronic diseases of the eye after milk or typhoid vaccine has ceased to be of value. The choice of a protein is determined somewhat by the extent of the general reaction it is capable of producing and the relative safety with which larger doses of it may be given.

The nonspecific proteins used most often in ophthalmology are diphtheria antitoxin, milk, and typhoid vaccine. They have the common property of producing fever, leukocytosis, and malaise. When any of them is given in dosage sufficient to produce a reaction with a fever of from 103° to 104°, inflammatory symptoms quickly subside, pain is relieved, and a marked change comes about in the disease. Subsequent doses are usually followed by a less marked general reaction, although healing may continue without interruption. The total benefit of milk injections is usually obtained if four injections of from 5 to 10 c. c. are given at intervals of from forty-eight to sixty hours; two injections

of typhoid vaccine are usually sufficient for good results, and diphtheria antitoxin should be given in moderate doses (2,000 to 5,000 units) daily for as long as desired. Injections of horse serum or human serum are usually not repeated, and never more than a second or third time. Systemic reactions from the use of vaccine are not desirable. Mild focal and local reactions are all that should follow any injection. The dose should be increased gradually if the reaction fall short of this requirement. Marked reactions from autogenous vaccines usually aggravate the disease and delay recovery. In chronic diseases, in which there are no systemic symptoms and only mild local symptoms, the use of vaccines, without previous administration of other forms of protein, seems to give the best clinical result. Protein therapy should seldom be used during the acute stage of abscess of the orbit with marked general disturbance. After the reaction to an acute infection has passed, small doses of nonspecific protein may be given to advantage if convalescence is slow or unsatisfactory. In milder infections large doses of foreign protein are used. In a case of panophthalmitis due to penetration of the eye by a foreign body (probably iron), in a boy of twelve. recently treated by the author, the reaction receded quickly although the globe was filled with pus and the eye was held tightly closed by marked swelling of the orbital tissues and the swollen lids. Although the globe subsequently ruptured, the swelling had gone down during the four-days course of treatment and the boy was comfortable instead of prostrated and in severe pain, as is so often the case.

Local diseases of a nonsuppurative character may yield to some form of nonspecific protein therapy, although the indications for such treatment are not so clear and the results less decisive. Tuberculosis of the eye may be treated by injection of tuberculin or by radiant energy; in both cases the result probably depends on protein reactions. In general the degree of

reaction to protein injection is governed by the severity of the infection for which it was given; the more acute the infectious process the more active the induced reaction. Accordingly, the dosage must be graduated to meet the condition; a large dose of protein must be used to combat an acute infection developing rapidly, a small dose for the more insidious infections. Acute corneal ulcers respond quickly to from 5 to 10 c. c. of milk, or from 1,000 to 3,000 units of diphtheria antitoxin, whereas chronic ulcers should, as a rule, be treated by smaller injections of proteins, from which less reaction is obtained. Vaccines are to be preferred in this type of case to milk or diphtheria antitoxin.

Local treatment of infected eyes is not to be supplanted by protein therapy but rather aided by it. There are very few inflammatory diseases of the eye in which the local use of drugs and heat is not indicated. General protein reactions aid materially in the healing of infected wounds, but antiseptics must be used locally. Application of heat often hastens the healing induced by the injection of protein. Modifications of the usual dosage of drugs given for their general action may also be used. Eyes affected with corneal ulcers should be treated by atropin and heat, and bandaged if the secretion is not profuse. Antiseptics, such as bichlorid of mercury, mercurochrome, silver salts, and iodoform, are indicated in cases of sloughing ulcers and should be used in addition to protein therapy. For nonsuppurative corneal diseases, potassium iodid, salicylates, mercury, iron, and many other drugs are given internally. In many diseases of the uveal tract, such as iritis and choroiditis, only atropin and rest are required in addition to the removal of the cause of the disease and protein therapy. Proteins of low activity are used except in cases of acute inflammation. Chronic iritis with posterior synechia and contracted pupil may be made worse by a severe protein reaction. Uveitis may be induced in a healthy eye by the injection of lens protein or uveal pigment. These

proteins should be used only after tests for sensitization have been made.

Foreign proteins that produce marked reaction, such as milk, diphtheria antitoxin, and special biologic preparations, should be used only in a hospital where suitable care can be given the patient. Usually the course of treatment is short, but the advantages of the few days of hospital care are sufficient to warrant the extra expense incurred. Vaccines and other proteins producing mild reactions can be safely given to ambulatory patients, but the patient should refrain from strenuous work and obtain as much rest as is consistent with the demands of his activity. When properly carried out, foreign protein therapy is a valuable adjunct to the therapeutic armamentarium in ophthalmologic practice.

Effect on Intra-Ocular Pressure of Intravenous Injections of Hypertonic Salt Solution. Attention has recently been called to the similarity between the cerebrospinal fluid and the aqueous humor. The dialysate nature of the cerebrospinal fluid has long been recognized, and the fact that in animals the production, composition and response of the aqueous humor to changes in the blood are the same, indicating a like nature, has now been conclusively shown.

The main factors controlling the secretion-absorption equilibrium of these fluids are the hydrostatic pressure of the blood (capillary blood pressure), the osmotic pressure of the blood, and the capillary permeability. The influence of external pressure, brought to bear on these fluids by the walls of the closed chambers into which they are secreted, results in the intracranial and intra-ocular pressures.

It has been shown experimentally in animals that there is a simultaneous response of both the intracranial and the intra-ocular pressures to general changes in the hydrostatic or osmotic pressures of the blood, although the intracranial and intra-ocular pressures are in no way way dependent on each other.

Changes in intra-ocular pressure produced by changes in the osmotic pressure of the blood have been experimentally studied in animals. Robert K. Lambert and Samuel Silbert[5] have recently made an investigation in order to observe systematically the effect on intra-ocular pressure in the normal human subject of varying the osmotic pressure of the blood. This variation was produced by intravenous injections of hypertonic sodium chlorid solution in a series of twenty-two cases, and of hypertonic dextrose solution in a few additional cases. Controls were obtained by the injection of isotonic sodium chlorid and dextrose solutions.

The patients chosen for this study were undergoing routine treatment for thrombo-angiitis obliterans, consisting in part of repeated intravenous injections of hypertonic sodium chlorid solution. The subjects were all ambulatory male patients, and they do not believe that there was sufficient departure from the normal in any case, because of the thrombo-angiitic condition to affect results appreciably, relative to ocular changes.

Different amounts and concentrations of the salts used were injected into the arm veins of the patients studied. The ocular tension of these patients was taken with an improved Schiötz tonometer before the injection and at five-minute intervals after it, until in most cases the tension had quite returned to its original level. The left eye was consistently used for all observations, having previously been anesthetized with phenacain. Three readings were taken at each five minute observation, in order to establish a satisfactory mean. As the technic of giving the injections by the gravity method was always the same, the duration of the injection itself was uniformly between five and ten minutes.

The general effects of the administration of hypertonic salt solutions have been dealt with before and no untoward symptoms or discomfort to the patient, other than thirst and a feeling of warmth, were produced.

(5) J. A. M. A., May 5, 1928.

In every case, with the exception of the controls in which 5 per cent dextrose and 0.9 per cent sodium chlorid solution were injected, there was a definite drop in intra-ocular pressure grossly palpable with the fingers and readily measurable with the tonometer. The average fall after the injection of 300 c. c. of sodium chlorid solution was 40 per cent of the original pressure, while after the injection of 150 c. c. of 5 per cent sodium chlorid the average fall was 21 per cent. In practically every case the maximum drop in pressure had occurred within forty minutes and had returned to its original level in from one or one and a half to two hours. Judging even from this limited series, a relationship between the amount of sodium chlorid injected and the degree of fall of intra-ocular pressure seems to be quite definite.

Whether or not the phenomenon studied will be found to have a practical application is impossible to predict at the present moment, although the results are suggestive and the method may find its uses. It is their intention to continue the study on patients with increased intra-ocular pressure.

It seems probable that the fall in pressure following the injection of hypertonic solutions is of a similar nature to that which occurs in advanced diabetes, probably owing basically to the marked and persistent rise in blood sugar and the coincidental change in the osmotic pressure of the blood.

Ephetonin in Ophthalmology. Ephetonin, a synthetic preparation similar to ephedrin, was tested by C. H. Satter[6] for its action on the eye. He found that in from 0.1 to 10 per cent solutions it dilates the pupil, reaching a maximum after three minutes and lasting from two to three hours. While the enlargement of the palpebral fissure lasts three hours the effect on the pupil generally subsides after from four to six hours. Ephetonin solutions do not suffer from boiling, or standing for months. It dilates the pupil more in the dark than in the light.

(6) Klin. Monatsbl. f. Augenh., October, 1927.

The ciliary muscle is not influenced by it, but in eyes predisposed to glaucoma the tension is increased by it. However, 2 per cent pilocarpin produces maximum miosis of the pupil diluted by ephetonin. Ten per cent solutions do not act more than 5 per cent solutions, which are recommended for diagnostic purposes, in no way distressing the patient.

The reaction of the different diseases of the eyes to different forms of *light ray therapy* is discussed by W. Stock[7] and the reaction of the different tissues is given, with the estimated dosage. The use of the rays from infra-red to ultraviolet is discussed, also the different lamps, together with radium and roentgen treatment. The author especially recommends roentgen treatment for tuberculous scleritis, sclerokeratitis, tuberculous conjunctivitis, dacrocystitis, and infected tissues after sac operations.

The Value of Antiseptics in Modern Ophthalmic Surgery. Many surgeons seem to be of opinion that the field of intra-ocular operations requires a somewhat similar course of preparation as is essential when a skin surface is involved. They are impressed with the possibility of disaster in the way of sepsis if such preparations are not carefully observed.

Arnold Lawson[8] considers the question of treating the ophthalmic operation field, antiseptically or aseptically, from four points of view: (1) contamination from the conjunctiva; (2) contamination from instruments and dressings; (3) contamination from the fingers of surgeons and assistants; and (4) contamination from the lash area.

There are, of course, other minor sources of contamination, but the ones just mentioned are the most important.

The Conjunctival Sac. Many years ago the author published the report of an exhaustive inquiry into the

(7) Med. Klin., November, 1927.
(8) Brit. M. A., Annual Meeting, 1927.

bacteriology of the normal conjunctival sac. The results of this investigation, which, so far as he is aware, have never been contradicted, may be summarized as follows. The *normal* sac is in itself antiseptic and requires no treatment prior to operation. So far as its lower section is concerned it is never sterile; it always contains many organisms, but these are either in themselves perfectly harmless, or, if not so harmless, their virulence is speedily destroyed by some inherent antiseptic power of the conjunctiva, which in this respect resembles the peritoneum. This can be easily proved by growing cultures from the lower sac and injecting a solution into the conjunctival sac of animals or even subconjunctivally. In neither case does anything happen. The normal conjunctival sac can never be sterilized for even twenty-four hours by any known means, and all attempts to effect this by antiseptic lotions of sufficient strength to act as effective germicides are futile, simply tending to defeat their object by setting up a reactionary irritation.

Long before antiseptic or the later aseptic surgery was introduced intra-ocular operations were performed with comparative safety, as compared with operations on the body. Indeed, long after the principles of aseptic surgery were generally accepted, ophthalmic surgeons as a class took no very special precautions. Lawson was the first surgeon at Moorfields Hospital to adopt an overall, and his election was in 1900; his teacher, Sir John Tweedy, up to the time of his retirement in that year, always used his index finger to effect counter-pressure, and to prevent the eye rotating inwards when making his cataract section, instead of employing fixation forceps. The results obtained then will bear quite a favorable comparison with those seen nowadays with masks, caps, overalls, and all the other appurtenances, which are quite rightly held to be *de rigueur*. He does not advocate a neglect of precautionary measures before operation; the point he wishes to make is that the routine use of antiseptic measures arises from a wrong

appreciation of facts. What we have to ensure is not that the conjunctiva is sterile, for that is unnecessary and impossible, but that it is healthy, and we can do that by the simplest means. The one great factor in determining this point is the presence of discharge, which can be definitely proved by tying up the eye for a few hours with an aseptic pad. If any discharge appears on the pad on removal or is found clinging to the lashes or canthi, then the conjunctiva is unhealthy, and means must be taken to free the sac from the cause of the discharge before operation is undertaken. Taking smears from the conjunctiva, and acting on the report of the presence of organisms found by this method of examination, is only of value if discharge is present; in its absence the organisms found may be held to be avirulent and harmless. As a matter of fact it is generally possible to tell by mere inspection whether the conjunctiva is healthy or not, but the author always adopts this well known and simple expedient of determining it.

If the conjunctiva at the time of operation is healthy it may safely be assumed that it will remain healthy during post-operative treatment under bandage and pad, and such is indeed the case.

Contamination by Instruments and Dressings. This may be dismissed in a cursory manner, for it is a first principle of all surgery that instruments and dressings must be sterile. The instruments should not only be sterile but dry.

Contamination from Surgeons' and Assistants' Fingers. The surgeon's fingers as a source of contamination may obviously be a fruitful cause of disaster. Some surgeons avoid trouble by wearing rubber or other forms of gloves, but he found the disadvantages of gloves in destroying, as they do, the fine sense of touch which is so important in many ophthalmic operations, to outweigh entirely their manifold advantages in maintaining asepticity, and he entirely gave up their use many years ago in intra-ocular and strabismus opera-

tions. But if no gloves are used the surgeon must be meticulously careful that no part of any instrument other than the shaft or handle is ever touched by his fingers. It has to be remembered that washing and scrubbing the hands before operation in no sense renders the fingers sterile. It has been shown that rubbings taken from fingers freshly washed and scrubbed in warm water produce luxuriant growths of organisms, and that while removing surface contamination to some extent, the hands still remain a means of readily infecting the wound. He endeavors to counter the point to some extent by well soaking his hands in spirit after scrubbing, and by having a bowl of spirit at hand during operation in which he can rinse his hands at any moment if desirable. Often, surgeons, when operating for strabismus, pick up needles with their fingers and put the needles in the needle-holder, instead of using serrated forceps for the purpose, with the consequence that the sutures are apt speedily to become more or less septic. Then, again, sutures are themselves a ready means of contamination, even after careful sterilization. The satisfactory manipulation of sutures presents real difficulties and requires meticulous care. It is presumed that in cases where sutures are going to be employed the skin of the face as a matter of course will be shut off by a gauze mask excluding all except the operation field, while the scalp is guarded by a folded sterile cloth. The sutures must be kept free from the surgeon's fingers, and this can only be effected by the greatest attention to detail. If, as is commonly the case, the needles and threads are rolled each one on a piece of folded gauze or lint, the needle should be disengaged from the roll with serrated forceps, as just mentioned, and the suture, as it is unrolled, should be held by the assistant in a pair of serrated forceps, and kept free from all contact with his or the surgeon's hands until the suture has been properly adjusted; and when it is being tied the surgeon must be extremely careful that his fingers never

approach that part of the suture which is applied to the wound area. It is all perfectly simple, but often there is lacking that delicacy of attention to detail which is required.

It must be admitted that, even with the greatest attention to detail, sutures will sometimes touch something that they should not, and in this respect an efficient antiseptic, which can without any irritation whatever be applied to the wound area, is most helpful, and gives the surgeon a great feeling of security.

There is nothing so good for this purpose as flavine. A solution of 1 in 1,000 of this drug can be freely applied to the eye at the time of applying the sutures, and thereafter it can safely be dropped into the eye twice daily in a strength of 1 in 4,000 without causing the slightest disturbance or without producing the smallest delay in the healing process. The charge has been made against flavine that it delays healing, but this accusation, when flavine is used of the strength just mentioned (1 in 4,000), is entirely baseless, healing pursuing its natural course by first intention.

Contamination from the Lash Area. The last point is contamination from the lash area, which is the neighborhood most difficult to preserve clean when an eye has to be kept bandaged for any length of time. It is not the most important, because there is not the same risk of infection of the operation field from the ciliary border as there is from the other sources of contamination —the conjunctiva, the instruments and accessories, and the surgeon's fingers. On the other hand, it is quite impossible, unless special means are taken, to keep the lash area from becoming dirty, and often very quickly so when the eye is kept tied up. In other words, it is quite impossible to sterilize the ciliary borders satisfactorily on account of the organisms which lie beneath the surface round and about the lash follicles. The testing pad worn before operation may be entirely free from all discharge, and the lashes themselves be apparently

perfectly clean, but soon after operation, even if they have been cut short, as they should have been, the stumps are apt to get sticky and dirty, and the discharge will then tend to get more and more objectionable, unless the source of trouble can be checked.

It is, therefore, in this regard, as well as in the dealing with sutures, that a non-irritating, efficient antiseptic becomes of extreme value, and once more he urges the use of flavine, which will generally do its work admirably.

After every operation he covers the affected eye with a gamgee pad well sprinkled with a 1 in 4,000 solution of flavine. It makes a delightfully comfortable dressing, which he changed twice daily; if this procedure is followed the lash area will rarely cause any trouble whatever. If trouble does occur it will be of a mild character and easily controlled. Something must then be used in addition to, or as a substitute for, flavine; there is nothing better than a 2 per cent solution of protargol employed twice daily as drops. Used at this strength protargol never irritates the wound, and it acts very efficaciously in arresting the discharge.

To sum up, then, the gist of these few remarks is to urge that the maintenance of a healthy operation field with quick normal healing can be obtained by the simplest methods before, during, and after operation. Antiseptics of any kind are only needed as *extra* measures, especially with regard to needles, sutures, and the lash area. If to these simple measures is added meticulous attention to detail, suppuration in the operation field can be eliminated with absolute certainty.

One exception must, however, be made to this assertion, and that arises when force of circumstances prevents the taking of routine precautions. It is occasionally necessary to operate on an acute glaucoma when there is intense congestion and obvious sepsis. In such an exceptional case the best antiseptic to use is hydrogen peroxid, with which the eye is flooded immediately

before the knife section is made. It is much better than flavine, because the latter is strictly an antiseptic in the true sense of the word, and is not of much value when sepsis is already present.

The author states that in his private practice he has never experienced the tragedy of intra-ocular suppuration after operation.

From his several years experience Reichert[9] found *corodenin an excellent prophylactic against ophthalmia* caused by cinema lights. It also gave subjective relief in affections with intense photophobia. This is perhaps due to impregnation of the tissues with corodenin, the rapid removal of which is prevented by simultaneous instillation of adrenalin.

Tumors

Chloroma. Green tumors resembling leucosarcoma, originating apparently in the bones of the skull, less frequently in the ribs and sternum, have been reported in the literature since Allan Burns made the first description in 1823. The very appropriate name chloroma was first used by King in 1853, and since then practically all of the cases, about one hundred in number, have been reported under that name. With the better understanding of the nature of the leukemias and other diseases of the blood forming organs during these years, our knowledge of chloroma has increased and it has been classed in this group, but is considered as a distinct clinical entity. The literature contains many excellent case reports, as complete as the general pathologist or pediatrician could wish, but very little concerning the microscopic study of the eyeballs. Richard C. Gamble[1] reports a case occurring in a seven year old girl, which was diagnosed early, observed continuously, a complete post-

(9) Klin. Monatsbl. f. Augenh., February, 1928.
(1) Illinois M. J., December, 1927.

mortem examination made, and the posterior half of each eye was obtained for study. (Figs. 22 and 23.)

Post-Mortem Report. Post-mortem examination showed both orbits almost entirely filled with green tumor tissue, pushing the eyeballs forward and extending backwards into each middle fossa. The bones of the base of the skull and both temporal bones were diffusely ramified with soft green new-growth. The dura was studded with pinhead to 2 cm. sized nodules, some red-brown, others green; these were most numerous at the

Fig. 22.—Chloroma. Moderate proptosis. Paresis of left facial nerve.

base, in each middle fossa. The calvarium was tinged olive green. There was a foramen magnum pressure furrow 4 mm. deep. The fat of the scalp in places was green, likewise the subcutaneous fat in the midline of the trunk. There were small petechial hemorrhages in the skeletal muscles, in the greater omentum and in the

peritoneum. The posterior surface of the upper part of the sternum was pale green, due to the small tumors in the mediastinum. The surface of each lung was pale dirty green mottled with hundreds of red-brown areas, likewise the pleura where it was in contact with the ribs and spine. The spine was markedly infiltrated with green tumor tissue. The heart was normal except for many small hemorrhages. The blood clots were brown. The lungs on cut surface were mottled red and brown, no green. The mesentery was almost completely

Fig. 23.—Chloroma. Extreme proptosis, with extreme ulceration of both corneas; complete paralysis of left facial nerve.

occupied by green lymph nodes, and the lymph nodes along the abdominal aorta were green. The liver extended 4 to 5 cm. below the costal arch, on cut surface it was mottled with fat in small lobular areas; no green areas were seen. The spleen was huge, weighed 170

gm. and on cut surface was normally mottled pink and red, no green. The right kidney was mottled with green on cut surface, the left was entirely green. Both ovaries were green. The thyroid had a greenish tinge. The thymus was of normal size and was mottled with green. The adrenals showed no change.

The posterior half of each eye was removed postmortem, fixed in formalin, sectioned in paraffin and stained with hematoxylin and eosin. Both eyes are alike. The retina is detached, due to loss of support by the vitreous, and forms a central strand. Only a small portion is seen in the sections. There are a few small retinal hemorrhages. The most striking pathological change involves the choroid. Its thickness is increased from two to six times by a diffuse infiltration of various types of white blood cells, both inside of the choroidal vessels and in the stroma. The predominating cell is a little larger than a large lymphocyte, has a moderately dark staining single round or oval nucleus, and a non-granular violet colored cytoplasm (with this stain). These cells should probably be classed as myeloblasts. In addition a few small lymphocytes, some large lymphocytes, a small number of polynuclear leucocytes and rarely an eosinophile with either a single or multiple nucleus is seen. Mitotic figures are present in a few of the myeloblasts. Some of the choroidal vessels contain erythrocytes, but they are few in number compared with the white cells. The same types of cells are seen within the lumen of one of the vortex veins and in the vena centralis retinae. The optic nerve is slightly edematous in its intra-ocular portion and is entirely free from cellular infiltration. The sclera shows no change. Pathological diagnosis: Leukemic infiltration of the choroid; pipilledema; retinal hemorrhage.

Sections of the tumor mass from each orbit are alike. The various types of cells seen in the choroid are present here in about the same proportions. The cells are quite closely and evenly packed together supported by

a moderate amount of reticulum. Many small endothelial tubes are seen, filled with these cells and an occasional erythrocyte. Veins where seen are many times partially filled with these cells, the arteries never. The extrinsic ocular muscles are in many places separated into individual fibers by the infiltration of the tumor cells. Sections of the dura mater show a similar splitting up into small fibres. Many small petechial hemorrhages are seen in the dura and in the mass of tumor tissue invading it, but no necrosis.

Sections of other organs show the same filling of the veins and infiltration of the tissues by these cells, the kidney and lung in much the highest degree.

This case may be regarded as a usual one of myeloid chloroma, its typical features being: (1) Occurrence in a child seven years old. (2) Proptosis of both eyes due to bilateral asymmetrical, green tumor masses originating from the bones of the skull. (3) Moderate degree of leukemia with many granular myeoblasts and increasingly severe secondary anemia. (4) Greenish leukemic infiltrations and nodules in various organs. (5) Involvement of second, seventh and probably eighth nerves. (6) Enlargement of regional lymph glands and spleen. (7) Rapid course. (8) Fatal termination.

Some of these features are lacking, or at least changed in many cases of undoubted chloroma. The majority do occur in children, a few in infants and a fair number in adults. A few cases have been reported in which the primary site seemed to be in the ribs or sternum.

The leukemic infiltration of the choroid is found only in chloroma. It is the chief cause of the very pale or even yellow appearance of the fundus which is characteristic of leukemia. That it can also occur in chloroma and when the white cell count is much lower than is usually the case in leukemia is of some clinical importance. The possibility of a green color being seen with the ophthalmoscope is suggested. In this case opacity from corneal infiltration prevented a satisfactory

fundus examination in the later stages of the disease.

Ocular Syndrome of Pituitary Tumor Complicated by Extraneous Factors. The ocular syndrome of pituitary tumor has been well established by many authors, and the associated structural changes are readily recognized. The ocular changes produced by pituitary tumors can be briefly summarized, as (1) lowered central visual acuity, (2) pale optic disks, and (3) bitemporal, or homonymous, scotomatous, or peripheral field defects. These changes are generally associated with enlargement of the sella turcica, with or without erosion of the clinoid processes. The history of the visual disturbance discloses definite progressive loss of vision with fluctuations, in one or both eyes. Glasses, as a rule, are of no aid in increasing the visual acuity.

Inasmuch as any one of the three factors, sphenoiditis, chronic simple glaucoma, and chronic alcoholism, can produce definite ocular changes, the greatest importance should be placed on definite anatomic ocular data.

W. I. Lillie[2] gives the findings in three cases of pituitary tumors; the first associated with purulent sphenoiditis, the second with chronic simple glaucoma, and the third with chronic alcoholism. He shows that the hemianopsia present in all three cases is the result of the pituitary tumor and not from the complication.

The importance of the bitemporal hemianopsia defect of the visual fields in these three cases can not be overemphasized. In the author's experience, an inflammatory condition has never produced bitemporal hemianopsia, with the exception of basal gummatous meningitis, or multiple sclerosis. This group of inflammatory lesions is so small when compared to the group of bitemporal hemianopsia due to chiasmal lesions, namely, pituitary, interpeduncular, nasopharyngeal, suprasellar, tumors of third ventricle, primary tumors of the chiasm, and aneurisms, that too much importance should not be placed on the extraneous factors. The usual effects on

(2) Am. J. Ophth., December, 1927.

the optic nerves of inflammation or toxin is characterized by retrobulbar neuritis with decrease in central visual acuity associated with central or cecocentral scotoma, with preservation of the peripheral fields. Many bizarre field defects are produced by inflammatory lesions either unilaterally, as in tabes dorsalis, or bilaterally, as in optic atrophy produced by syphilis of the central nervous system and encephalitis. But they are not to be confused with the almost pathognomonic field defects produced by tumors near or at the chiasm. Finally bitemporal or homonymous hemianopsia, associated with lowered visual acuity and normal or pale optic disks, should always suggest tumor near or at the chiasm, regardless of any or all extraneous factors.

Ocular Phenomena Produced by Basal Lesions of the Frontal Lobe. In a series of 86 definitely proved lesions of the frontal lobe examined in the Mayo Clinic, 13 were situated in the basal portion of either one or both frontal lobes. In these 13 cases a definite ophthalmologic syndrome was revealed.

Wilbrand and Saenger reported several cases of tumor of the frontal lobe with unilateral choked disks, but emphasis was not placed on ophthalmologic observations, and unfortunately perimetric fields were not described. They also report having noted a basal lesion of the frontal lobe with a unilateral choked disk, and mention having seen several other similar cases, but again the perimetric fields were not mentioned. It was not until Kennedy, in 1911, reported six cases of basal lesion of the frontal lobe that the value of the ophthalmologic data as an exact diagnostic syndrome was properly emphasized. He found "a true retrobulbar neuritis with the formation of a central scotoma and primary optic atrophy on the side of the lesion, together with a concomitant papilledema in the opposite side."

Nine cases are reported briefly by Walter I. Lillie[3], to show that the appearance of the fundus is not so

(3) J. A. M. A., Dec. 17, 1927.

important in localizing the site of the lesion as is the central scotoma, which is always found on the side of the lesion.

Only one of these cases is here given, that of a 25 year old woman, who complained of recent headaches and failing vision. The symptoms had become more

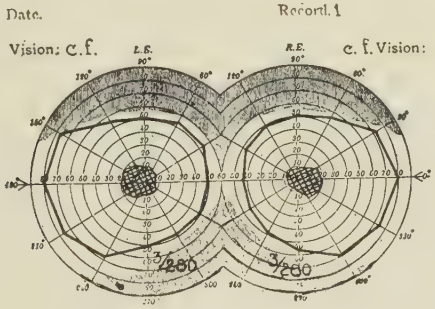

Fig. 24.—Right eye, mild concentric contraction for form and blue color vision; patient unable to recognize red and green; cecocentral scotoma; left eye, mild concentric contraction for form and blue color vision; patient unable to recognize red and green: cecocentral scotoma.

frequent and severe during the last four weeks. Vision began to fail in the two eyes at the same time. The headaches were bifrontal, but predominated on the left side and the pain often extended to the left cheek. The onset and decline of the headaches were gradual; they lasted from one to eight hours, and occurred at intervals of from one to three days (Figs. 24 and 25.)

The general examination was negative except for bilateral laceration of the cervix. The Wassermann tests of the blood and spinal fluid were negative; roentgenograms of the head and chest were negative. Fingers could be counted with both eyes. The pupils were slightly irregular, with diminished reaction to light. The ocular movements were normal. The fundi showed mild edema of each disk, radiating into the retina, with

swelling of less than 1 diopter in each. The fields showed slight concentric contraction for form, and bilateral cecocentral scotoma. There was loss of red and green vision; blue could be seen peripherally. The neurologic examination disclosed weakness of the right angle of the mouth, paresthesia of the left cheek, without objective sensory disturbances, slightly ataxic gait, and a normal sense of smell. The patient died suddenly in the hospital, and necropsy revealed a diffuse glioma of the left and right frontal lobes.

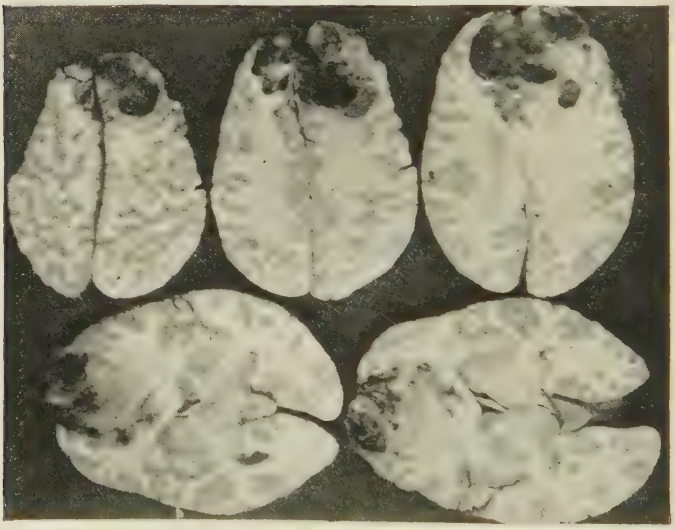

Fig. 25.—Diffuse glioma of both frontal lobes extending into the basal portion of each lobe (necropsy).

When first examined this patient appeared to have optic neuritis, as there was only mild edema of the disks and a definite cecocentral scotoma in each eye. Treatment was about to be started on this hypothesis when the patient suddenly died.

Orbital Cellulitis Due to Empyema of the Ethmoidal Labyrinth. That orbital complications may arise in

connection with suppuration of the accessory nasal sinuses is strikingly shown in the case reported by Thomas A. Woodruff and Ellis B. Gray[4]. It can be readily understood how this is likely to happen when the anatomy of the neighborhood is borne in mind. Anteriorly, the frontal sinus, anterior ethmoidal cells, and maxillary sinus bound the orbit above, medially and below, respectively; while the posterior group, the sphenoidal sinus and posterior ethmoidal cells, are in relationship to the posterior half of the medial wall of the orbit. Suppuration of these cells may extend to the orbital tissues, directly through involvement of the bony wall separating them and through dehiscences, and indirectly by venous and lymphatic channels.

Suppuration of the ethmoidal labyrinth is frequent and often primary without frontal or maxillary sinus involvement, though the ethmoid usually shares with these sinuses in inflammation. If the orifice of the anterior cells becomes occluded by inflammation and the cavity distended with pus, symptoms referable to nose, orbit or forehead will follow. Empyema rupturing externally has been known longest of all the inflammatory diseases of the ethmoidal labyrinth since it reveals itself by symptoms easily noted externally. Most often it is seen as a cellulitis or abscess confined largely to the medial angle of the orbit. When an acute process of the ethmoid ruptures into the orbit, it manifests itself by swelling of the eyelids, proptosis and outward and downward displacement of the eyeball, fever, chills, and headache. As the process extends, complete immobility of the eyeball may ensue. If an abscess develops and does not drain it may cause a fatal meningitis or cavernous sinus thrombosis by extension through the orbital roof or optic foramen.

Since symptoms referable to the nose may not be complained of, all cases of sudden orbital swelling with fever and chills should be investigated from the view-

(4) M. J. & Record, April 4, 1928.

point of the sinuses. Ordinarily suppurations of the sinuses drain into the nose, but if the orifice of the cells has become blocked by inflammation, inspection of the nose may show very little indeed; in fact, the patient may have little complaint referable to the nose. As happened in the case which is here reported, this condition is very likely to be observed first by the oculist rather than by the rhinologist.

Case.—Peggy H., a girl of eight years, in the latter part of June, 1927, suddenly began to complain of headaches. Her physician found that there existed some redness and swelling of the right eyelids and several degrees of fever. He made a diagnosis of probable erysipelas and instituted treatment for that condition. Her fever continued and after three days the swelling of the lids became more pronounced and the eyeball protruded noticeably. At this juncture, an ophthalmologist was consulted who found the lids hard, swollen and edematous, the right eyeball markedly proptosed and immobile and turned slightly outward. Pressure caused severe pain and met firm resistance. The ocular conjunctivæ were red and chemotic. There was no swelling or other signs of inflammation of the optic nervehead. No history of injury was elicited, but the child had been in swimming several days before the onset, which later was considered as a possible etiological factor. A slight nasal stuffiness and a slight discharge were the only symptoms she had, which pointed to her nose. A rhinological examination was then made. On finding a boggy swollen right middle turbinate and several drops of creamy pus in the middle meatus, it was decided that a closed empyema of the ethmoidal labyrinth had ruptured into the orbit. Due to the disfigurement which necessarily would have followed an external operation, it was decided to attempt drainage by the endonasal route. Under ether anesthesia a submucous resection of the nasal septum was first done for the sake of obtaining as much space as possible. The mid-

dle turbinate was resected by Sluder's technic. Free pus was obtained. The ethmoidal cells were then exenterated and the lamina papyracea was removed. No free pus was obtained from the orbital cavity. Following the operation, the discharge from the right nostril was quite profuse and coincidentally the proptosis and fever subsided. Slight movement of the eyeball was present two days afterwards and gradually improved as the swelling became less. The patient made an uneventful recovery and left the hospital with a divergent squint, which now has disappeared.

The Eye and Systemic Conditions

Ocular Conditions Associated with Diabetes. Diabetes is one of the common general diseases in which interesting and important eye changes occur and knowledge of their relative frequency, their recognition, and prognostic significance is a distinct aid to the general diagnostician. At times these eye changes cause great deterioration of vision through a variety of different causes. Even without visual impairment they may be the means of making the first diagnosis, being more obvious to the ophthalmologist than to the general physician. The ocular complications most frequently encountered in diabetes are described by Frank E. Burch[5].

Changes in refraction are common diabetic manifestations and follow a quite definite rule, sometimes with mathematical precision. According to Anderson they occur in 14.6 per cent of diabetics. The tendency is toward myopia, with suddenly increased blood sugar, toward hypermetropia after a rapid decrease in blood sugar (especially after energetic treatment) with a return to the individual's normal refraction as carbohydrate metabolism becomes stabilized. These changes may be as great as seven or eight diopters and are probably due to osmotic processes involving the lens, caused

(5) Journal-Lancet, April 1, 1928.

by concentration of the blood and tissue fluid with sugar content. The refraction variation cannot be explained by changes in the refractive index of the ocular fluids because the percentage of sugar in the aqueous and vitreous could not possibly develop the concentration necessary to produce some of the extreme refractive changes found. The range of accommodation is generally found normal and is not a factor; in most patients refractive change occurs after accommodation has become fairly inactive. Accommodative paresis would not explain the myopia at all. Lenticular change seems a plausible explanation for these reasons: (1) because it most easily explains astigmatic changes which also occur; (2) the lens is known to be naturally unstable in diabetes as illustrated by the development of cataract; (3) Elschnig observed no refractive change in one eye when its lens had been removed for cataract whereas the other eye showed refractive changes when its lens still functioned. Duke-Elder explains the lens change by osmotic physical laws; that is, when the sugar content of the fluid in which the lens is bathed reaches a high point, an actual increase in lens volume occurs thus producing myopia; when sugar excretion is at a maximum, the osmotic flow is from the lens to the intraocular fluids with resulting marked hypermetropia; as sugar metabolism stabilizes, lens volume becomes normal and its refraction reverts to the original normal.

Retrobulbar neuritis in diabetics is rare. It is absolutely identical clinically with the evidences found in nicotin and alcoholic amblyopia. Failure in vision is accompanied by a central scotoma for red and green or both and because of this it has been confused with the amblyopia from those causes. There can be little doubt of its definite entity because of its occurrence in some cases where nicotin and alcohol may be ruled out especially in the cases occurring in women. Moreover there is rapid improvement upon the disappearance of acetone and oxybutyric acid from the urine. The exact

toxic factor is unknown. Zentmeyer believes arteriosclerosis, incident to diabetes, is the real cause. Ronne studied two cases after necropsy, finding distinctive degenerative, but not inflammatory, changes in the tracts, differing from those found in other types of retrobulbar neuritis and occurring throughout the papillo-macular bundle from the ganglion cells around the macula to the primary optic centers.

There can be little doubt that *iritis* may be definitely caused by diabetes. It is usually bilateral, characterized by great swelling of the iris with gelatinous exudate and amenability to carbohydrate-free diet. It is fairly rare if one excludes cases among diabetics in which focal infections are present, for in every iritis one may rarely exclude this factor in etiology.

Postoperative iritis, in which the traumatic factor also enters, is usually of a sluggish type, but it may be most disastrous in its effect on vision, destroying the effect of perfect operation.

Ocular palsies are fairly common in diabetics affecting mostly the extrinsic muscles of the eye. The incidence of ocular palsies among diabetics is relatively much higher than otherwise. Undoubtedly, it occurs as a peripheral neuritis in many instances; but it also at times is probably due to small hemorrhages, either centrally or peripherally. Diplopia is most frequently caused by involvement of the sixth nerve, or branches of the third, and when the latter is involved, vertical diplopia or unilateral ptosis is the commonest finding. One may not exclude vascular degeneration in etiology in extra-ocular palsies but their frequent transitory character and the involvement of branches of the third nerve more frequently than involvement of the whole nerve, and because they occur when blood chemistry shows high sugar concentration, leads one to infer that they may more frequently be due to peripheral neuritis. The prognosis is relatively better than in non-diabetics, when extra-ocular paresis is directly attributable to hy-

pertension and arteriosclerosis alone. In no case of diplopia in an adult should the blood chemistry be overlooked.

A rare but interesting condition found in diabetes is *lipemia retinalis*. Benedict and Wagner have reported an instance of this with leukemia, but practically all other cases in the literature have been associated with diabetes, in which the fat content of the blood has reached at least 4 per cent. The retinal vessels have a characteristic salmon or milky appearance, the arteries being almost indistinguishable from the veins. They seem to lose their cylindrical contour, have the appearance of being overfilled, becoming quite white toward the periphery. Lipemia retinalis was originally accepted as a terminal symptom of juvenile diabetes but several cases have cleared up entirely under treatment.

The *retinitis* associated with diabetes occurs in about 10 per cent of hospital cases, but undoubtedly the incidence is much higher than this, occurring as it does in adults and not in younger patients of whom the percentage of hospital admissions is relatively higher. The question has been raised whether diabetic retinitis has any distinctive features. It oftentimes resembles the arteriosclerotic retinitis so well described by R. Foster Moore, and it is true that it occurs principally in patients who are subject to arteriosclerotic retinitis. From the latter it differs in the comparative absence of the stellate figures at the macula. One does not find so frequently the exudative "snowbank" patches seen in renal retinitis unless evidence of nitrogenous retention is also evident. The patches have rather sharp-cut edges with rather a solid, soapy or waxy appearance, according to Moore, and are unevenly distributed as an irregular ring wide of the macula. On the other hand, one cannot say that the retinitis is dependent on blood conditions, such as acidemia or hyperglycemia, for this is frequently greatest in younger subjects, and in the young patients one does not see diabetic retinits. The

fact that it occurs in subjects who have cardiovascular disease speaks for the importance of angiosclerosis as an associated factor in etiology. Undoubtedly, age, tissue and vascular changes are more important factors than the blood chemical changes incident to diabetes itself, in which respect it differs from renal disease.

The most characteristic picture is that which shows around the central region of the retina, small, bright, punctate spots in the vicinity of the main vessels on either side of the nerve but especially around the macular area. (Frontispiece.) Abundant hemorrhages are comparatively rare and are usually petechial in character in the deeper layers of the retina. Wagner found retinitis in 44 of 300 diabetics, but in 80 acute cases none showed retinal changes. Practically all of his patients with retinitis were of the mild type showing evidence of vascular disease. Of course we have arteriosclerotic and albuminuric retinitis occurring in diabetics. The prognosis for diabetic retinitis is relatively much better than in the purely arteriosclerotic and albuminuric types so commonly seen, and under insulin therapy will undoubtedly become much better.

The best understood of all the ocular complications of diabetes is *cataract*. Clegg found 87 of 1,660 cataract patients had glycosuria. In a series of 514 cataracts operated on, glycosuria has been present 24 times, or about 4 per cent of all cases, that is, all cases coming to operation. Many other cases seen have been refused operation because it has involved too great hazard. True diabetic cataract is probably typically seen in young subjects, always bilateral, starting in the posterior layers of the lens. The juvenile type is characterized by great rapidity of development,—often a few weeks. The cataract appears blue-white, milky, and homogeneous. Even by early study with the slit-lamp it is not possible to differentiate diabetic lens opacity from other types occurring in senile subjects. The characteristic appearance in an adult during the early stages is the diffusion

of the opacities between the posterior primary embryonic nucleus and the cortical demarcations instead of the usual senile spike-like and cleavage lines. The exact cause of cataract in diabetics is subject to controversy. It is probably not due to dehydration of the lens. Burden-Cooper believed there was a definite hydrolytic factor. Undoubtedly, the total incidence of cataracts is much higher than is indicated from statistics taken before blood sugar estimations were routinely made. In the matter of limiting operative hazard, Garrod believes it is of greatest importance to properly prepare diabetic patients before operation by intervals of fasting and alimentary rest with regulation of the patient's carbohydrate tolerance, and elimination of hyperglycemia and acetonemia. Benedict has noted the untoward effect of insulin in the production of hemorrhages after operation and he advises that insulin be withheld after operation for at least four weeks, depending upon the proper dietetic management entirely.

In the author's experience, postoperative hemorrhage into the anterior chamber, in diabetics after an iridectomy has been done, is relatively much more common than in the ordinary run of cases. Among 24 operated cases (in practically all of whom blood sugar was previously reduced to a near normal) useful vision was obtained in 21. With one of the failures, insulin had been used over a period of two years, and throughout her operative convalescence. She obtained useful vision immediately but a disastrous hemorrhage occurred six weeks after a supposedly safe convalescence. In a second case, aged 85, hemorrhage occurred on the fourth day, but some useful vision was preserved. The third case developed hemorrhage and iritis with secondary glaucoma after three months. Thus, the results, as regards this small series, were successful in about 85 per cent, considerably less satisfactory than the average for cases of all types. In general, it may be stated that since we are now able to stabilize metabolism, the out-

look for cataract extraction in diabetics is increasingly good, almost as good as in the non-diabetic cataract.

All diabetic ocular complications of themselves constitute an open chapter as regards prognosis under modern therapy, for the prognosis of underlying causes has undergone, and is undergoing, complete revision since Banting's discovery. The treatment of ocular complications of diabetes is essentially the treatment of the underlying faulty metabolism. It should not be undertaken by the ophthalmologist but is distinctly a problem for the internist.

Ocular Complications of Encephalitis Lethargica. In a symposium on this condition by the Royal Society of Medicine[6], James Collier emphasized the difficulties in diagnosis, mentioning especially cases in which no hint as to the nature of the disease was given during the early days of the illness. Prefrontal tumors with rapid onset might closely simulate encephalitis lethargica. The speaker maintained that the characteristic symptoms of sleepiness, ophthalmoplegia, parkinsonism, spontaneous movement, dysuria, and constipation were due to the position of the lesions in the brain stem and not to any specific quality of encephalitis lethargica. He reported two fatal cases with such a syndrome, one of which was encephalitis lethargica and the other a rapidly growing soft tumor. Poliomyelitis and tuberculous meningitis had also to be distinguished, but examination of the cerebro-spinal fluids would help considerably in the diagnosis.

Collier then dealt with lesions of the nervous mechanism which subserved vision. Mentioning first the occipital lobes, the speaker said that he had not seen any case in which "cortical blindness" had been definite. One patient had a persistent left homonymous hemianopia, persisting altogether unchanged for four years, showing a lesion in the visual path. With regard to the optic nerve, one patient presented during the

(6) Brit. M. J., Feb. 18, 1928.

acute stage the syndrome of retrobulbar neuritis. Papilledema he had seen only in one case in any degree in which the diagnosis was verified pathologically; minor degrees of swelling of the disk did not occur very often. The causes of such papilledema might be, firstly a rise in intracranial pressure, and secondly that the neuritis, from local inflammation, came far enough forward to be seen at the optic disk.

Ophthalmoplegia was met with in two forms: paralysis of any of the peripheral oculomotor nerves might occur, or a nuclear ophthalmoplegia, hardly ever complete, affecting both eyes, leaving the optic axes unparallel might be found. Herpes certainly occurred, but the speaker had not actually seen a case.

He added two definite signs which, in his opinion, occurred in practically no other disease. One was the loss of upward movements of the eyes and the other was a curious oscillation of the eyeballs when the patient attempted to perform certain movements of the eyes.

F. A. Williamson-Noble referred to recent pathological work on the disease which had an ophthalmological basis, since it began with Grüter's work in 1910 on vaccinia of the cornea in rabbits. The outcome was the indication of a close relation between the virus of herpes simplex and the virus of encephalitis lethargica, the principal point of difference being the enhanced neurotropic activities of the encephalitis virus. This speaker enumerated the eye lesions occurring as a sequel to encephalitis lethargica. These comprised jerky eye movements, lack of blinking, blepharoclonus, partial ptosis, unequal pupils, deficient accommodation, deficient convergence, nystagmoid jerkings, diplopia with squint, lid retraction, oculogyric crises, sluggish reaction to light, Argyll-Robertson pupil (rare), squint (rare), tapping the globella making the eyes flicker, and "blinking sign" (Kinnier Wilson) on lateral deviation. Of these signs this observer emphasized loss of power

of convergence as being one of the commonest associated with the parkinsonian syndrome: this was also one of the commonest eye troubles in paralysis agitans. He mentioned also the curious tonic eye fits or oculogyral crises: these consisted of spasmodic attacks of conjugate deviation of the eyes, most frequently vertical, often associated with a marked emotional factor. The speaker referred to the occurrence of papilledema, mentioning four cases, in all of which the diagnosis of encephalitis lethargica was found to be incorrect at autopsy. Optic neuritis was also very rare, and the absence of optic disk changes appeared to be a negative sign of value in the diagnosis of encephalitis lethargica.

New Instruments

An Instrument for Muscle Tucking. This instrument, devised by W. J. Harrison[7] consists of two principal parts, namely: (1) the equivalent of a spring forceps, the blades of which may be approximated by means of the nut and threaded bar; (2) a hoop, situated between the forceps blades and which may be raised or lowered in relation thereto, by means of a wing nut shown at the upper extremity.

The instrument being applied perpendicularly to the muscle, with the cross-bars forming its base squarely at right angles to the edges of the muscle, the hook is lowered sufficiently to be passed under the muscle, then, by means of the wing nut above, the hook is raised, drawing the muscle up between the blades of the forceps. When sufficient length of muscle has been drawn up, the forceps is closed by means of the round nut at the side of the instrument, and the muscle loop is securely held while a double suture, guided by the notch at the extremities of the blades, is passed through the center of the muscle. (Fig. 26.)

(7) Am. J. Ophth., April, 1928.

Detailed technic of operation: The conjunctiva is grasped by forceps about six mm. from the limbus over the muscle to be operated upon. By means of blunt pointed scissors a vertical incision about eight mm. long is made, and by dissection the conjunctival and subconjunctival tissues are cleared from the muscle. The strabismus hook is then passed under the muscle in the usual manner. A second hook is similarly applied and the two are then separated about fifteen mm. so as to bring the muscle forward and somewhat on the stretch.

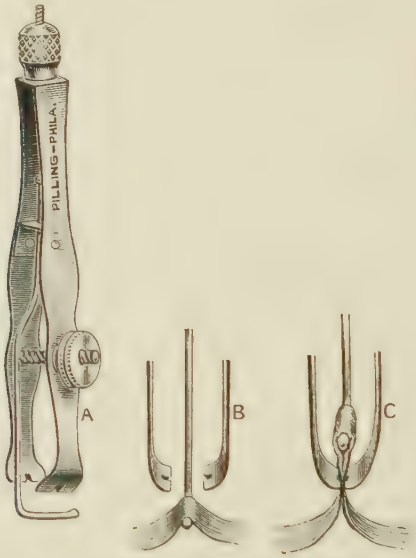

Fig. 26.—Eye tendon tucker (Harrison).

The under surface of the muscle is curetted by means of a right angle curette. This curettement favors adhesion of the opposing surfaces of the looped muscle. The instrument is then held in the perpendicular position and the hook of the instrument is placed under the muscle. Following this procedure the strabismus hooks are

removed. Then, as described above, the hook of the instrument is drawn up to create the tuck, the blades are closed and a double plain catgut suture is passed through the muscle at the notch in the blades.

This notch is important, as it avoids injury to the sclera, and facilitates the passage of the needle. The catgut is severed at the needle end, and the two halves of the tuck are tied off. There is no difficulty in placing the knot of each half of the tuck directly under the blade. The instrument is then removed from the tucked muscle by simply lowering the center hook and releasing closed blades by means of the side nuts. The conjunctival wound is closed by two sutures, anchoring the tuck between. Both eyes are bandaged.

In case of convergent squint, atropin is instilled daily in each eye at the time of dressing. In divergent squint, no atropin is used. In convergent squint, the eyes are uncovered about the fourth day, the conjunctival sutures being removed in about eight days. In divergent squint, the eyes are uncovered in two days and the conjunctival sutures removed in eight days.

There is little reaction and the lumping is not permanent. It has been possible to correct between thirty and thirty-five degrees of squint by operating on one eye. For high degrees, double tucking will be necessary.

Advantages of the instrument: (1) simplicity of instrument, with resultant simplicity of operation; (2) easily sterilizable; (3) amount of muscle tucked easily seen; (4) notch in instrument prevents injury to sclera and permits easy introduction of the suture; (5) closure of the blades on the muscle tuck avoids traction when tying suture, giving a secure, tight knot; (6) there is no interference by assistants' hands, as the instrument can be held by the distal extremity and the operator has free access to the muscle.

Advantages of the operation: (1) It is safe. In the Worth operation sutures are taken in the episcleral tissues and occasionally the globe is punctured. An acci-

dent of this type is rare, but always possible. (2) It is a comparatively simple procedure. No sutures are taken except to tie off the loop and close the wound. In the Worth and Reese operations three sutures are employed. This necessitates greater detail in execution of the operation, and later these sutures must be removed, sometimes with considerable difficulty. (3) The sutures never slip or tear as occasionally noted in the Worth operation.

A Chimney for Use in Retinoscopy. Since the matter of light is so important a factor in satisfactory retinoscopy, the cause of failure in obtaining proper results by this method of examination, is poor illumination. E. M. Blake[8] believes gas light is superior to electric light for

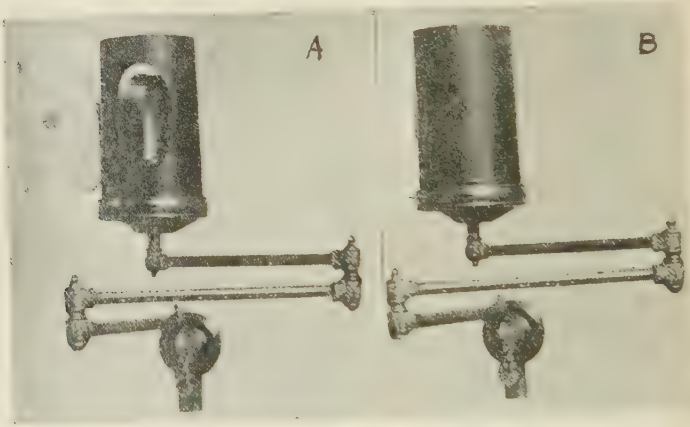

Fig. 27.—Chimney for use in retinoscopy: *A*, window open, hinged door turned aside; *B*, window closed for retinoscopy.

this purpose, and has constructed a chimney for use over an ordinary Welsbach Junior light on an adjustable bracket. The chimney is made of tin, painted a dull black on the outside and is 15 cm. high and 8 cm. in diameter. A large oval window, 8½ cm. long by 4½ cm. wide, is cut into the chimney. This window is closed

(8) Am. J. Ophth., November, 1927.

by a hinged door which has a 13 mm. opening in the center. The opening should be so placed that it is opposite the brightest part of the flame. (Fig. 27.)

For inspection of the lids and anterior segment and for the reflecting ophthalmoscope the door is open, and plenty of light is obtainable. For retinoscopy the door is closed and a small, bright source of light is available, which brings out the central fundus reflex much more clearly than a large source of light can do. Even after hours of use the door does not become too hot to be opened by the fingers.

Rule for Measuring Accommodation, Near Point of Convergence, and Interpupillary Distance. The rule here described was devised by F. H. Thorne[9], for the purpose of supplying an efficient and rapid instrument for measuring the accommodation, the near point of convergence and the interpupillary distance. The Prince rule, which is made of wood is generally used for this purpose. This rule is equipped with a metal slide supporting the test card, but in wet weather the wood becomes swollen, causing the slide to pinch and thereby making adjustments difficult as well as causing some discomfort to the examinee.

The rule here illustrated is made of square brass tubing 7 by 7 mm., and 430 mm. in length. It is equipped with a brass slide (a) supporting two test card holders (b, b), one for either eye, an adjustable bridge (c) formed to rest comfortably upon the bridge of the nose and held in this position by two lateral tongues (d, d), one white ball (e) in the center of the slide for ocular fixation in measuring the near point of convergence, and a handle (f) for adjusting the slide. (Fig. 28.)

The rule is calibrated in diopters and millimeters. The diopter calibrations range from 14 to 2.5 diopters. This range is sufficient to cover practically all cases appearing before the examining boards.

The millimeter scale ranges from 25 to 425 mm. The

(9) Am. J. Ophth., July, 1928.

near point of convergence is measured from the center of rotation of the eye, which lies 13.5 millimeters behind the anterior surface of the cornea. In measuring, the rule is held 11.5 mm. in front of the cornea, making thereby 25 mm. in all that has to be added to the reading on the scale at the point where the eyes diverge. Because of this the millimeter scale begins at 25 instead of zero, at the tip of the lateral nose tongue, making further addition unnecessary.

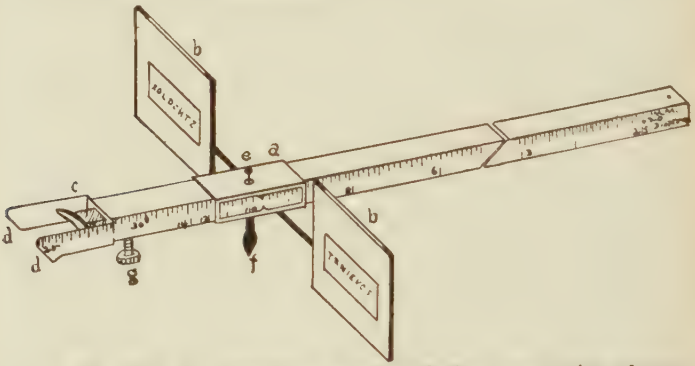

Fig. 28.—Rule for measuring accommodation, near point of convergence, and interpupillary distance.

The adjustable nose bridge permits adjustment of the end of the rule to its position 11.5 mm. from the anterior surface of the cornea and the lateral nose supports assist in holding it there. The adjustable bridge is maintained in its position in the rule by the thumb screw (g).

As the rule is comparatively small and of light weight, the millimeter scale furnishes an excellent means of measuring the interpupillary distance. The test card holders are 3 by 3 centimeters square and constructed to form metal frames in which the test cards are inserted. These cards fit loosely and can be replaced as desired.

This instrument has been in use at the school of Aviation Medicine for the past year and it has proved very satisfactory.

Combined Corneal Spud. In removing foreign

bodies from the cornea, Alfred Dean[1] finds that the combined sharp and dull corneal spud offers a decided advantage over the individual instruments.

The instrument he has devised for this purpose is 5½ in. in length. The handle is 4 in., from which extends

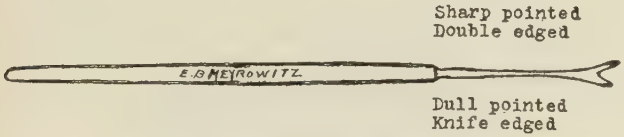

Fig. 29.—Combined corneal spud of Dean.

a slender shaft, which near its extremity broadens and flattens; and from which two blades are formed, separated by an angle of 45 degrees—or each 22½ degrees obliquely from the shaft. The longer one, 5x1 mm., is mediumly sharply pointed and has a double knife edge, which permits a forward cutting or backward cutting stroke, at the same time not being so sharply pointed but that it can be used as an elevator when used in the lateral or scraping position. The shorter blade, 4x1 mm., is bluntly rounded at its extremity, with a knife edge which functions best when used in the lateral position as a scraper or elevator of superficial foreign bodies. (Fig. 29.)

The construction of the instrument is such that when held in the pen position it permits the rotation from the sharp to the dull spud without changing position of the operator's hand.

A Combination Head Band and Trial Frame. In estimating refraction, especially in children, this combination of the ordinary trial frame and head band has been found very convenient by John Parry Price[2]. It can be readily fitted to the varying sizes and shapes of the head, and once fitted remains firmly in position. (Fig. 30.)

(1) Am. J. Ophth., November, 1927.
(2) Lancet, Feb. 18, 1928.

Nasal and Eye Chambers for the Application of Heat or Cold. The eye chamber, devised by J. N. Fishbein[3], is spherical, about 2 in. in diameter, constructed of light copper, with the concave surface toward the eye. The rim has a hard rubber guard, so that no part of the skin is touched by the metal surface. It has an inlet and an outlet at the lowest and highest portions of the

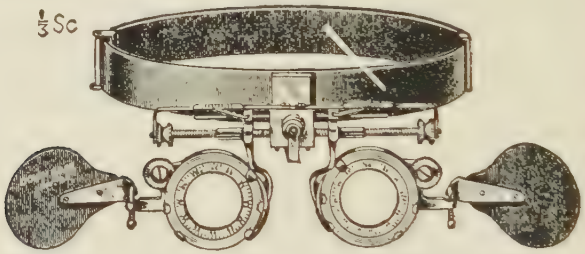

Fig. 30.—Combined head band and trial frame (Price).

chamber, to which are connected rubber tubes. About the center of the lower tube is a bulb which, when compressed creates a vacuum and in this manner fills the chamber. A valve in the bulb prevents its flowing back in the wrong direction. The lower ends of both tubes are weighted down by concealed weights to hold them in the basin. (Figs. 31 and 32.)

The manipulation is very simple. The patient, or the nurse, presses the bulb about every ten minutes, and this changes the water in the chamber. For cold applications, a basin of ice water containing pieces of cracked ice is used. For hot applications the basin is placed on a heater. It is useful in such conditions as keratitis, iritis, neuritis, styes and cysts, in which hot applications are desirable, or in panophthalmitis, dacrocystitis, or other inflammations in which cold compresses are indicated.

The Scotograph. N. Bishop Harman† recently showed

(3) Jour. A. M. A., May 26, 1928.
(†) Brit. M. J., Aug. 18, 1928.

an instrument designed by him to facilitate measuring the fields of vision where there is a central scotoma. The following is an abstract of his description of this instrument and its manner of use. Field taking is difficult

Figure 31.

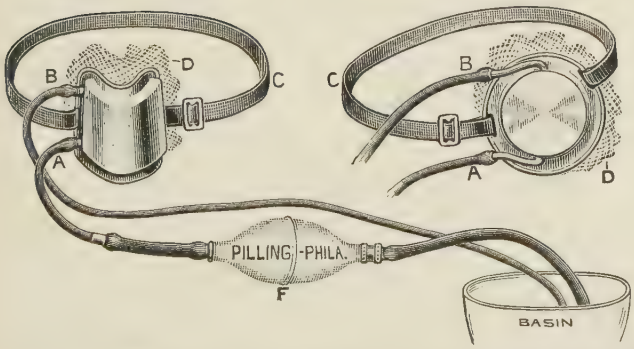

Fig. 32.—Nasal chamber complete with tubes, bulb and basin; eye chamber showing only tubes but similar to nasal chamber. *A*, inlet; *B*, outlet; *C*, elastic band; *D*, gauze; *F*, rubber bulb.

where the macula of one eye is out of action. The device shown gets over most of these difficulties. A tube is bent at a right angle midway in its length, and the two arms are so arranged as to give the seeing eye a

false fixation spot which will correspond in position to the real one marked on the perimeter or scotometer. Figure 33 shows the plan of the instrument in reduced scale. E is the eyepiece. At the knuckle there is a double circle marked H, for the reception of the handle. At

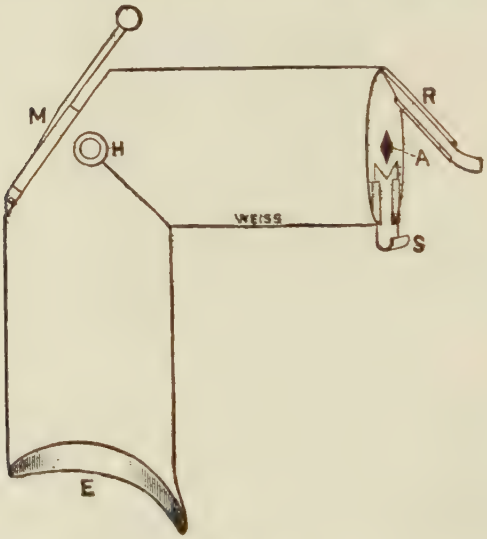

Figure 33..

the extreme right-hand end of the tube is a plate, in the center of which is cut a diamond-shaped aperture. At the knuckle of the bend of the tube is a large hole covered with a hinged lid M, fitted inside with a plane mirror. The patient holds the instrument before the eye which has fixation power. He sees the patch of light reflected from the mirror lid at the knuckle. The field of vision of the other eye and the scotomata are thereon mapped out. The instrument can be used for either eye. It has been shown with the handle for holding in the hand of the patient, but the makers are prepared to fit it with a crank arm to clip on to the upright of the perimeter.

The Ear

ALBERT H. ANDREWS, M.D.

THE EAR

Hearing Tests

The Rationale of Tuning Fork Tests. After an extensive discussion of tuning fork tests R. Sonnenschein[1] offers the following conclusions.

1. Weber test for lateralization. Fork placed on median line of vertex, forehead or root of nose. (a) Normally heard in vertex ("in the head"). (b) Usually lateralized in worse hearing ear in conduction apparatus impairment. If both ears have middle ear affection sound goes to worse of the two ears. (c) Usually lateralized in the better ear if disease of perception apparatus is present in other ear. If both ears have perception impairment, sound usually lateralized in the better ear.

2. Schwabach test for duration of bone conduction in the individual as compared with the normal, using living control, or comparing with average hearing for the particular fork employed. Fork usually placed on median line of vertex or forehead; it may be set on mastoids. Note whether bone conduction is normal, lengthened or shortened, a slight diminution being of no significance. The age of the patient, the thickness of the hair or bones, the manner of application of the fork, firmness of contact of fork, may give variation in length of bone conduction. A definite lengthening of bone conduction means impairment of conduction apparatus (adhesions, fixation of stapes, etc.) A definite shortening of bone conduction means involvement of the perception mechanism (inner ear or auditory nerve). A decided change in bone conduction is in many ways the key to diagnosis and prognosis in ear disease.

3. Rinne test for comparison of air with bone conduc-

(1) Ann. Otol., Rhin. & Laryng., March, 1928.

tion in the same individual. The stem of the fork is placed on the mastoid (avoiding contact with auricle), and when no longer heard the prongs are held close to without touching auricle or vibrissae, and parallel with the ear, and the duration of hearing by air noted.

If a negative Rinne is suspected—e. g., if the Schwabach was found lengthened, test air conduction first and then bone conduction. Normally the Rinne is positive (air conduction longer than bone). There are about seven varieties of Rinne (two forms of the positive, three varieties of the negative and two of the indefinite or plus-minus type.)

4. Gellè test, for determining mobility of the footplate of the stapes. Compressing the air in the external auditory meatus gives diminution of hearing in normal cases by pushing stapes into oval window; where fixation of stape dial footplate is present, no change in hearing occurs with increase in air pressure.

5. Stenger test, for unmasking simulation of total unilateral deafness. Two forks of exactly the same pitch are used; patient unaware that more than one fork is sounding. The fork nearer one ear drowns out sound of fork at other ear.

6. Audiometers are being used considerably in testing, and with them we get accurate measurements of hearing in sensation units. Audiograms obtained give graphic idea of the state of hearing, which may be preserved for future reference and comparison. With properly calibrated forks, provided with the "constant" of damping or decrement, one is able to obtain a similar curve, but if many pitches are to be tested the process is somewhat more tedious than with the audiometer.

7. Resonators and other appliances should also be employed as previously mentioned in the methods of functional testing of hearing.

Test for Hearing in the New Born: The Conditioned Reflex. C. A. Aldrich[2] points out the difficulty in de-

(2) Am. J. Dis. Child, January, 1928.

termining the presence or absence of hearing in infants and the fact that previous tests have been dependent on visible response of the baby to sounds. This response consists in a sudden start of the entire body, winking of the eye and crying out, or a combination of these activities.

In a recent attempt to solve this problem he devised the plan of using what he calls the conditioned reflex, with sound as one stimulus and pain as the other. In this instance, at half hour intervals a small concealed bell was rung beside the baby's crib, while at the same time the sole of the foot was scratched with a pin. When these stimuli were applied the child cried out and drew up the leg. After twelve or fifteen applications the infant cried and drew up the leg when the bell was rung and the foot was not touched. The author feels sure from this response to noise alone that the child heard, and suggests that this might be developed into a reliable method of determining hearing in infants.

Investigations With Amplifying Apparatus. By means of a chain of filters to magnify the high tones of speech and to minimize the low tones C. von Eiken[3] found that patients with nerve deafness were enabled to hear much better. This is not necessary in deafness of the middle ear.

The External Ear

Angioma of the Auricle. J. R. Page[4] reports case of angioma of the auricle, which appeared at birth and continued for about two years when the ear was amputated. During this time the ear was unsuccessfully treated by radium and by excision of part of the angioma and ligation. (Figs. 34 and 35.)

Aural Exostosis. J. C. Scal[5] reports a case in point which illustrates the bad results following operation.

(3) Ztschr. f. Hals-, Nasen- u. Ohrenh., 1927—1928.
(4) Ann. Otol., Rhin. & Laryng., March, 1928.
(5) M. J. & Record, April 4, 1928.

M. G., a dental student, aged twenty-nine years. For several years he had had the sensation of both ear canals becoming occluded. Examination revealed a narrowing of both external auditory canals, more marked on the right side. There was no inflammatory process present. The ear canals seemed to be closed in by a bony projection from the posterior canal walls. The drums were inspected with difficulty, but appeared to be normal in all respects. All ear tests showed normal responses.

Fig. 34.

Fig. 35.

He was advised to leave this condition alone, but instead he permitted an operation by a well known otolaryngogolist. Incisions were made over the mastoids and the bony prominences apparently removed. The result of the operation was disastrous to the right ear in that, due to the attending traumatism of the operation, the ear canal became practically entirely occluded, admitting only a pin point. The middle ear became infected, and the discharge ceased only after a year's treatment.

Otoscopic examination showed the right ear so occluded it barely permitted the entrance of a small ear speculum. This showed a small funnel shaped canal, the end of which being about the size of a pin point. A view of the drum could not be obtained. The left ear showed the canal reduced in calibre, barely permitting inspection of the drum, with the smallest caliber speculum. The tympanic membrane appeared to be normal.

Functional tests showed lateralization to the right, C 2 fork fair, two seconds; mastoid prolonged. Voice test showed the right ear negative, left ear at five metres. The watch test was only heard at right ear on contact, left ear at five metres.

Vestibular tests showed past pointing normal. The turning tests showed an individual nystagmus of ten seconds. The caloric tests could not be carried out as the occlusion of the right ear canal did not permit the fluids to come in contact with the drum.

When operation is indicated the intraaural route is advised. The operation consists in elevating the periosteum and chiselling off the bony growth.

In this case the operation not only diminished the hearing, but subjected the patient to more than a year of unnecessary treatment. A train of nervous symptoms also developed which compelled the patient to give up his dental studies and made a practically useless neurasthenic of him.

[The plan of chiseling away the exostosis and part of the wall of the auditory canal is still considered the proper treatment for these conditions.—Ed.]

Papillary Pigmented Nevus in the Outer Canal of the Ear. A woman, aged 42, complained of a "wart" in the outer canal of the ear. She irritated it with a hairpin, causing considerable bleeding and persisting pain. A new formation almost the size of a pea was found at the lower wall of the canal between the anterior and middle thirds. It was semisolid, brownish black, with a rough surface, and was attached by a broad base. Eight

months after its removal from the canal a smooth scar remained. A detailed histologic report is given by H. Mueller[6]. Clinicians call attention to the fact that exploratory excisions and incomplete removal can cause an unlimited growth of pigmented nevi. Therefore, Gruenberg chose the radical retro-auricular removal with his patients, and recommended this method as the safest.

Report of a Case of Vascular Tumor of the Membrana Tympani. F. Richman[7] reports the case of a child, 15 years old, who at the age of seven months had had an otitis media (left). The ear had apparently healed, but there was some residual deafness.

On examination of the left ear three reddish-brown prominences were seen in the posterior-superior quadrant, covering the drum membrane to a large extent. Wherever the drum could be seen it appeared normal. On probing, the tumors gave the sensation of bullae covered with an impressible membrane. Incision of one of them produced bleeding which was easily controlled by packing, but the tumor promptly recurred.

Radium treatments were given, the applicator being introduced into the external auditory meatus, as close as possible to the ear drum. The results of the treatment showed that the blood vesicles had disappeared, most of the drum membrane being visible. A remnant of the previously existing vesicles appeared as a hard, solid tumor, size of a small pea, and giving the impression of a sessile fibroma of the drum. The author does not consider the case one of highly vascularized granulation polyp, because of the fact that the tumor consisted of fairly large blood vesicles that were covered with a distinct membrane; further, that after shriveling of the tumor following the radium treatment, the area of the drum on which the tumor had been located appeared quite atrophic, but not perforated, showing that the

(6) Ztschr. f. Hals-, Nasen-u. Ohrenh., March 18, 1927.
(7) Laryngoscope, February, 1928.

growth came from the drum membrane, and not from the middle ear.

From these facts he draws the conclusion that in this case an abnormal development of the vessels of the membrana tympani was the nucleus for the vascular tumor, and that, perhaps, the inflammatory condition of the ear in infancy was the exciting factor for the growth of the tumor.

The Middle Ear

An Epidemic of Acute Otitis Media Characterized by Positive Gaseous Pressure Within the Tympanum. During the winter of 1925-26 several cases of acute otitis media were observed in which the predominant characteristic was a bulging drum membrane, evidently distended by positive pressure of air or some other gaseous substance within the tympanum.

The first cases observed were thought to be caused probably by blowing the nose in the presence of some "ball valve-like" action within the auditory tube. However, when several other cases had been seen and finally more than one in a family (three in one instance) appeared, the probability of it being something in the nature of an epidemic caused by some specific gas-forming organism was recognized. Cases continued to appear in the fall of 1926 and the following winter. Again in several instances more than one case would appear in the same family.

The literature has not been carefully and completely searched, so that this may not be a new condition. However, V. V. Wood[8] cannot recall having previously observed similar cases in such number as to suspect an epidemic, although occasional cases of ballooned drumheads have been seen at all times of the year.

No specific organism has been isolated as yet. The

(8) Laryngoscope, November, 1927.

usual pyogenic bacteria have been found. A streptococcus has been present in every case cultured. One case also showed an unidentified spore-forming organism, but in no instance has a gas-producing tendency been evident in culture.

No case has been hospitalized early so it could be thoroughly worked up from a bacteriologic standpoint immediately upon paracentesis or before secondary infection would be probable. They should be cultured on a greater variety of media perhaps than has been done by the writer.

The constant appearance of a streptococcus may be significant. The more the writer sees of the streptococcus, the more he feels that it is the mocking bird of bacteriology and apes the clinical characteristics of many other bacteria, as syphilis does of many other diseases. Streptococci have been known to produce gas to some extent. However, the production of gas is an unusual characteristic of any definite type of streptococci known so far as the writer has been able to determine.

Appearance of the Drum on Otologic Examination. If seen early there may be only slight redness of the upper quadrants or perhaps a few enlarged and engorged vessels running towards the short process. The drum soon begins to bulge and frequently there is no redness or loss of transparency below Shrapnel's membrane. Occasionally the entire membrana tympani is so red and nontransparent that it is impossible to say what is the cause of bulging if seen for the first time late in the disease. Other drumheads show a surprising absence of redness and the gaseous cause of the distention is unquestionable. The hearing is always down.

Course of the Condition. In spite of the fact that a streptococcus has been found in every case cultured or examined bacteriologically, the condition has shown a surprising mildness of course and lack of the development of the usual much-feared streptococci complica-

tions. There has not as yet been noted any especially virulent features or dangerous complications. No case of mastoiditis has yet appeared in the writer's experience. The temperature is not high and is usually about in proportion to the severity of the accompanying upper respiratory infection which always precedes or accompanies the development of the otitis media.

One of four things usually happens: (1) Many cases subside spontaneously without going on to suppuration or the evident production of serous exudation. (2) Some cases become so markedly distended that paracentesis is necessary to relieve the intratympanic pressure and subsequent pain. (3) Other cases develop a serous exudate which is not apparently purulent. (4) A few have been seen to eventually develop a suppurative otitis media.

Thus it will be seen that the infection acts as does any other group of cases of acute otitis media, with no typical features except the positive gaseous intratympanic pressure.

In four or five cases the escape of gas or air upon paracentesis has been forceful enough to produce a distinct hiss. Needless to say, these cases were in great pain when incised.

There is rarely any difficulty in differentiating this condition from the so-called myringitis bullosa with blebs on the drum, which is so frequently seen accompanying influenza.

Chronic Purulent Otitis Media with Fusiform Bacilli and Spirochetes. In two cases of chronic purulent otitis media in infants, reported by R. Motta[9], fusiform bacilli and Vincent's spirochetes were found in the discharge. Some pseudodiphtheria bacilli were also detected. In both patients, the discharge stopped following local treatment with arsphenamin.

Some Otitic Complications of Influenza. In report-

(9) Policlinico, Jan. 23, 1928.

ing six illustrative cases P. J. Keogh[1] stresses the following points:

(1) Post-influenzal bullous myringitis is not uncommon.

(2) All cases showing marked earache after influenza are not cases of acute otitis media.

(3) Hearing tests are of great value in differentiation; differentiation is important, as the treatment for one condition is contraindicated in the other.

(4) Serous labyrinthitis is a frequent otitic complication of influenza.

(5) Great destruction may have taken place in the mastoid process without exhibiting any tenderneses over the bone.

(6) Myringotomy is a more satisfactory operation than stab paracentesis, and is not so likely to need repetition.

The Treatment of Chronic Suppurative Otitis Media with Tubal Perforation with the Aid of the Catheterizing Eustachioscope: Case Reports. L. K. Pitman[2] believes that the location of the perforation in chronic suppurative otitis media is in that portion of the drum which is in the immediate neighborhood of the infection. In this article the writer considers only those cases where the infection is limited to the Eustachian tube, characterized by anterior perforation of the drum membrane. In spite of cleaning up infections of the nose and throat many of these cases continue to have a chronic discharge. The author considers local tubal treatment as both logical and practical, and presents his "catheterizing Eustachioscope" for this purpose.

The apparatus consists of a pair of catheter guides—right and left—and a naso-pharyngoscope. The illustration (Fig. 36) shows the right guide attached to the nasopharyngoscope, and also the left guide separate. The guide can be slid along, also rotated about the naso-

(1) Irish J. M. Sc., November, 1927.
(2) New York State J. Med., Oct. 1, 1927.

pharyngoscope. In operation, the catheter guide, containing a catheter, is attached to the nasopharyngoscope, so that the egress portion extends along side the mirror. In this position, under slight cocainization, the combined instrument is easily introduced into the nasopharynx, under the inferior turbinate, in the same manner as an ordinary Eustachian catheter. The nasal orifice of the Eustachian tube is then brought into view; the guide, containing the catheter, is given a slight turn to increase the visibility of the catheter, and its free end is introduced into the Eustachian tube.

Fig. 37.—Patient bends head toward the affected side. Medication is forced through the Eusthachian tube by way of the catheter, running out through the perforated drum and the external canal.

Two guides are provided; one for the right ear and one for the left, because the same guide cannot be rotated to either side of the instrument without changing the direction of entry.

The treatment of chronic suppurative otitis media with tubal perforation, consists of irrigating the Eustachian tube (as illustrated in Fig. 37) with 3 to 5 c. c. of 20 per cent argyrol at each sitting for about 15 sittings. The washing is done twice weekly. When the discharge is

fetid, the following has been helpful in conjunction with the washings

R/x	Formalin	m5
	Hydrargyri	gr 132
	Alcoholis	oz ss
	Aqua dest. qs ad	oz. iii

gtts. 5 in ear 3 times daily

The author's series consists of nine consecutive cases. The functional test showed in all cases a middle ear impairment, before and after treatment. There was a noticeable improvement of hearing with the progress of treatment, as tested by a spoken and whispering voice, and the majority called attention to the fact that their hearing became more steady.

Five of the series showed anterior perforation of the drum membrane but not marginal. One case was of a bilateral condition, thus presenting an opportunity to employ two methods of treatment for comparison. The other four of the series showed anterior perforation, marginal type. One case was of a bilateral type thus also presenting an opportunity to employ two methods of treatment.

The foregoing cases are presented because of the several different conditions represented and because of the results obtained in the application of both the old and new methods in bilateral cases. Although owing to the newness of the instrument the number of cases so treated is extremely inadequate for positive conclusions, the results obtained are so gratifying as to warrant the introduction of this method among otologists with a view to determining its actual possibilities after more extensive use.

Medical Diathermy in Chronic Middle-Ear Deafness. A recent experimental trial of medical diathermy in chronic catarrh of the middle ear has so much diminished the deafness and tinnitus that D. McKenzie[3] draws attention to a method of diathermy in order that others may try it. In this method a beam of high-frequency

(3) Lancet, March 24, 1928.

current traverses the tissues between two electrodes and raises their temperature. It is solely to the rise in temperature that the therapeutic action of the remedy is attributed.

The electrodes used are made of metal, and are of the same size, their superficial measurements being 1 by 1½ inches. One is placed over the mastoid process, and the other is laid upon the face just below the prominence of the malar bone, or a little behind it. The position of the face electrode varies according to the shape of the head and that of the mastoid, the aim being to bring the two electrodes as nearly as possible into parallel planes. A pad of several layers of lint, thoroughly soaked in 10 per cent saline solution, is interposed between each electrode and the skin.

The patient should be lying down on a comfortable couch, and the electrodes may be strapped on with a rubber band and kept in position with suitable sandbags, but whatever method be adopted the contact must be close, or sparking will occur and the skin may be burned. The current varies from 0.7 to 1.4 amp., according to the patient's feelings (and according also to the ampèremeter, for these instruments show variations in their readings). It is gradually raised from zero up to the point when the patient begins to feel the skin under one or other electrode becoming too hot; the strength of the current is then gradually reduced until the point of tolerance is reached, and it is kept there for from 7 to 10 minutes. After the current is shut off the patient should remain recumbent for a few minutes, as vertigo is sometimes experienced if he assumes the erect posture too quickly. The treatment should be repeated every other day. As a rule, if benefit is going to be received, the patient will become aware of an improvement in symptoms before the end of the second or third week. The treatment is painless if care be taken not to overheat the skin, but as this may occur un-

expectedly a trained attendant should be at hand to regulate the current when necessary.

The application may be followed by a reactionaary dulling of the hearing for 18 to 36 hours, but many patients fail to experience any reaction. An increase in loudness of the tinnitus may also be observed and may persist longer than the period of dull hearing.

With the electrodes in the positions described, the current occupies the mastoid process, the middle ear and cochlea, the petrous bone and the Eustachian tube; then it crosses the middle line by the body of the sphenoid to pass by way of the floor of the orbit, the lesser wing of the sphenoid, and the body of the superior maxilla to the cheek.

The author feels that this form of treatment is most effective in cases of tubo-tympanic catarrh. It is contraindicated in otosclerosis and in the presence of pus.

The So-Called Ionization Treatment of Chronic Suppurative Otitis Media. It is the belief of H. L. Warwick[4] that the varying results obtained in ionization treatment is due to the use of the method in cases not fitted for it. Where the otitis is simple and uncomplicated, over 90 per cent of cures is possible, and in other cases where the complications (attic or mastoid suppuration, polyps, nasopharyngeal infection) have been taken care of, 80 per cent may be relieved.

The technic of the method is relatively simple. The ear must be well cleansed and gently syringed with a warmed solution of zinc sulphate containing 4½ gr. of zinc sulphate to the ounce of distilled water. The patient is placed in a reclining position with the infected ear up. The auditory canal is filled with the zinc sulphate solution, a Seigel otoscope inserted and gentle aspiration done to remove any air bubbles which may be in the ear canal and tympanic cavity.

The positive electrode is a short piece of pure zinc wire which is passed through a bit of glass tubing pro-

(4) Arch. Physical Therapy, April, 1928.

vided with a rubber tip to make it fit tight in the external auditory meatus. This glass tube is also filled with the warm zinc sulphate solution and placed into the meatus which has been previously filled with the solution. (If the perforation in the drum membrane is not large enough, one may use an attic cannula and inject the solution into the middle ear or may enlarge the opening.) The negative pole is connected with a suitable sponge electrode which has been moistened with a sodium chlorid solution and the sponge is held in the hand of the side opposite that being treated. A direct current of 3 milliamperes is slowly turned in and allowed to continue for 10 or 15 min. and then gradually turned off. The external canal is not dried. Greatest care must be taken to turn on the current very slowly, as otherwise the patient experiences some disagreeable reactions to even so small a current; and it should be turned off just as slowly. One must take care that the electrode does not come into contact with the walls of the external auditory canal else a burn may be produced.

It is necessary that one be provided with a direct electric current. A current that is both direct and finely interrupted such as that obtained from a motor-generator having about thirty or forty bars on its commutator is much to be preferred to that obtained from either storage or dry batteries, and the generator should be capable of delivering at least 10 milliamperes of current when connected with the patient. Such a current serves a twofold purpose. It propels the zinc ions into the ear bringing them into contact with the infecting organisms, and it produces a slight anesthesia which must to a large extent prevent the pain and discomfort during the treatment. The reaction produced by this current is in huge contrast to the rigid contractions produced by the galvanic current as obtained from dry cells or storage batteries. Further disadvantages of the battery current are that it readily produces vertigo, the patient complains of dizziness and that it seems as if the world were

whirling toward the cathode. There is usually nystagmus and inclination of the head toward the side upon which the positive pole is placed. A severe burning sensation is frequently experienced when a current from dry cells or a storage battery is employed. The direct current as obtained from a motor generator does not produce such reaction to an appreciable extent. An alternating current such as obtained from a commercial lighting circuit may not be used for this treatment under any circumstances. The use of this current has caused several otologists to proclaim that the method is of no benefit as well as being dangerous to the patient. This example shows the need of many otologists to inform themselves of the scientific principles underlying this method, and without which entirely satisfactory results cannot be obtained or expected.

Care must be taken that the proper wires from the generator are placed on their proper connections; the positive wire onto the zinc electrode to be placed in the ear, the negative wire to the sponge to be held in the hand. Should the wires be interchanged untoward results would be obtained. There would be no bacteriostatic action of the zinc ions. The negative current in the ear would act as a vasodilator, increasing discharge, softening tissue and possibly inducing hemorrhage. On the other hand the physical effect of the positive current which should properly be connected to the electrode in the ear is that of a sedative and vaso constrictor; it stops hemorrhage, reduces discharges and hardens tissue.

Some of the earlier workers advocated the use of glycerine as a constituent of the solution to be employed. It has been found in theory and in practice that such a solution is much less efficient than one consisting of only pure zinc sulphate dissolved in distilled water.

In the author's experience of treatment by so-called zinc ionization of several hundred cases of suppurative otitis media ranging in duration from a few weeks up

to sixty years, the best results have been obtained in cases which show uncomplicated tympanic sepsis, although complicated cases are usually readily amenable to treatment after correction of the complication. This is especially true in the use of the method following radical mastoidectomy.

A few cases of otitis media complicated by sinus infection were temporarily relieved by the treatment, as the patient declined to submit to surgical operation of the complications the ear will probably continue to suppurate. Those cases of otitis media following scarlet fever seem to be very resistant to treatment by zinc ions.

The Treatment of Otorrhea: With a Comparison of the Various Methods. J. A. Keen[5] has studied a series of cases of otorrhea in school children and has analyzed the end-results after a period of six months. The children have been treated alternately by the ordinary methods, and by zinc ionization. The author finds that 68 out of 78 cases have been remedied, and have remained dry for at least six months. Both methods seem to have been equally efficient, but the ionization method is decidedly more rapid in its results.

In only one case in this fairly large and repesentative group was a mastoid operation definitely advised. Some of the other persistent cases may possibly require operation later on, although none of them show granulations or evidence of cholesteatoma. The author is not as enthusiastic about routine treatment with zinc ionization as he is led to believe others are.

Experimental Cholesteatoma. Cholesteatoma was introduced in rabbits by suppuration of the bulla. Growth of the canal epithelium occurred through the tympanic membrane, whether the perforation was marginal or central. Even without perforation the epithelium might grow through the tympanic membrane in the presence of sufficient irritation. J. Berberich[6] believes the genesis

(5) Practitioner, July, 1928.
(6) Ztschr. f. Hals-, Nasen- u. Ohrenh., 1927—1928.

of cholesteatoma of the middle ear in animals resembles the early stages of experimental cancer in animals.

Otosclerosis

Some Mooted Points in Sound Conduction and Perception During the Course of Chronic Progressive Deafness. F. P. Emerson[7] believes that in this condition we have a local infection in the lymphoid tissue that initiates the deafness, accompanied at once by tinnitus and sometimes vertigo and nerve depression. Tinnitus appears at intervals throughout its course and almost always with any exacerbation of the local process, the exacerbation being further connected with the increased loss of tone perception by tenderness of the sentinel gland and hyperplasia on the side of the deaf ear. The course is intermittent and influenced by treatment of the infected lymphoid tissue and never by any measures to mobilize the ossicles in chronic cases. The hearing test is typical after the disease is established and chronic, and does not vary from that of nerve deafness where there is no pathology in the middle ear. It never resembles a typical case of otosclerosis and never varies from its own characteristic development in slowly progressive cases. The end result in all cases is nerve deafness, which is made worse by any intercurrent disease that lowers the resistance of the patient, or by any local or general infection.

If any of these cases improve by treating the infected lymphoid tissue alone, without any measures directed to the Eustachian tube or middle ear, they cannot be cases of otosclerosis or even of conduction deafness. While treatment of the nasopharynx influences the lymph and blood circulation in the tympanum, the same improvement in tone perception often follows the removal of chronically infected tonsils without local treat-

(7) Laryngoscope, March, 1928.

ment. It does not make the observation of less value because they relapse, but it is highly significant that the improved hearing remains good for an indefinite time and then is lost through infection. Any obstruction in the middle ear does not modify the typical hearing test of a chronic case of deafness, as the middle ear pathology follows the loss of tone perception.

The author concludes from his study: (1) That the conduction apparatus is never a factor during its course or in the end-result. (2) That it is an open question whether there is ever any obstruction in the Eustachian tube in chronic cases, except that due to trauma, tubercle or syphilis. (3) That nerve deafness is essentially like any other form of deafness. (4) That disuse never is followed by atrophy in a fully developed auditory organ. (5) That the only practical hearing test for otologists is the whispered voice.

The Relation of Progressive Deafness to Environment. In devoting years to a study of silica dust inhalation, D. C. Jarvis[8] has found it is necessary to study environment, both occupational and home, in an effort to estimate its influence upon the production of the clinical picture resulting from silica dust inhalation. The clinical picture resulting from silica dust inhalation and that of progressive deafness are so similar in many respects that one wonders whether the underlying fundamentals operating in each instance are not alike. The lungs by means of the bronchi and trachea communicate with the external air and the middle ear by means of the Eustachian tube likewise communicates with the external air. Both then to a certain extent are susceptible to the same respiratory environment, and both to a certain extent are influenced by certain clinical conditions of the nose and accessory sinuses. The pathologic changes in each instance are slight in their beginnings, more or less generalized in their distribution and slow in their development, the element of time being a neces-

(8) Laryngoscope, November, 1927.

sary factor for the development of each clinical picture. Between 10 and 25 years are necessary before a worker in silica dust presents himself for an examination of his lungs, and a like period of time seems to be often necessary before an individual presents himself for an examination of his ears.

For the purpose of study the writer divided environment into a number of phases: respiratory, dietetic, occupational and infection. A consideration of the infection phase of environment tends to lead one to conclude that while a relationship may exist between infection and the onset of progressive deafness, this relationship apparently seems to be a secondary one, rather than a primary one.

A consideration of the dietetic phase of environment tends to lead one to conclude that lymphoid tissue is present in proportion as fats are absent from the diet. Lymphoid tissue apparently represents suitable soil for the growth of micro-organisms. When there is an increased amount present in progressive deafness there seems to be a diminution in hearing for intensity. The proof of this seems to be the increase in hearing for intensity when fats, such as cod liver oil, are added to the diet.

A lowered alkali reserve apparently represents suitable preparation of the soil. This alkali reserve is estimated by a study of the degree of redness of the mucous membrane lining the nose. When there is a lowering of the alkali reserve in progressive deafness there seems to be a diminution in hearing for pitch. The proof of this seems to be the increase in hearing for pitch when alkaline treatment is used.

A consideration of the various phases of environment tends to lead one to conclude that progressive deafness may possibly be a local manifestation of a nutritional disaster.

Otosclerosis. G. J. Jenkins[9] considers that there is

(9) J. Laryng. & Otol., January, 1928.

a definite clinical and pathologic entity called otosclerosis, but that the causative pathologic process may be capable of producing a variety of symptoms and signs of extremely divergent character; furthermore, that other pathologic processes may produce the same symptoms and signs, with a similar divergence of character. In discussing the syndrome of otosclerosis, it was pointed out that the earliest symptoms may suggest an internal ear deafness, with loss of bone conduction. Other cases may be an admixture of signs of middle and internal ear deafness. The author further suggests that it is nearly always possible to demonstrate some degree of loss of bone conduction, especially of the low tones, even in the most characteristic types of deafness.

Many examples of the different types of deafness are given: middle ear, internal ear and mixed—all classed under the heading of otosclerosis. In several of these cases, roentgenograms of the internal ear were made by Dr. Graham Hodgson, who reported changes similar to those of otosclerosis. Many diseases other than otosclerosis produce similar symptoms and signs with the same extreme divergence of character.

Osteitis deformans, a general disease of the bone, which attacks the labyrinthine capsule from the outside, may also cause ear deafness which varies from a pure internal ear deafness to a pure middle ear deafness. The details of eight cases are given. The author believes that many cases of osteitis deformans are overlooked. It is possible for the two diseases, otosclerosis and osteitis deformans, to be concurrent. However, the author sectioned the temporal bones in three of the patients with osteitis deformans and was unable to find any changes in the bone suggestive of otosclerosis. Some degree of internal ear deafness may be found in cases of hyperostosis of the external auditory meatus. In the author's experience, a loss of bone conduction is almost constant in those cases. As the pathologic changes in the labyrinth peculiar to "progressive middle ear deafness"

have not been definitely described, the author believes that the description of this condition should be omitted from the textbooks. He believes that many of the conditions formerly diagnosed as such were really cases of otosclerosis.

The "otosclerosis syndrome" is common in cases of osteogenesis imperfecta. In this disease osteoporosis and new bone formation are not observed. The bones are delicate but complete and well formed. Details of the examination of the ears are given in three cases. The author concludes that this disease does not of itself cause any type of deafness, but many of the patients are affected with otosclerosis. Mention is made of Professor Nager's sections of the temporal bones in a case of osteogenesis imperfecta with otosclerosis.

In discussing certain changes in the Eustachian tube, middle ear, tympanic membrane and external auditory meatus, which have been regarded as characteristic of otosclerosis, the author regards these conditions rather as anatomic peculiarities associated with the disease than as results of the disease itself.

In commenting on the symptoms of paracusis, the author does not believe that the bony changes in the foramen ovale are sufficient to account for the variability of this symptom. The occurrence of vestibular symptoms is more common when the two ears are unequally affected by the otosclerosis, and the suddenness of the attacks of vertigo suggest a cause other than the possible changes in the bone in the vicinity of the vestibular nerve endings, as the effects of the slowly progressing disease of the bone would probably be compensated for centrally.

Otosclerosis: Its Clinical Aspect. These observations are based on the examination of 835 patients by F. R. Nager[1]. The incidence of otosclerosis in the series was 20 per cent of all ear conditions in patients examined. The onset of the symptoms was most commonly between

(1) J. Laryng. & Otol., January, 1928.

the ages of 20 and 30 years. In only 13.7 per cent did deafness manifest itself before the age of 16. The hereditary history was obtained in 58.6 per cent. The frequency of heredity is one of the main points given in support of the hypothesis that otosclerosis is a constitutional disease, but anomalies of the vegetative nervous system, chemical composition of the blood and the endocrine glandular function must also be considered.

The theory of the constitutional nature of otosclerosis is further supported by its frequency in both ears. In the present series it was unilateral in only 13.6 per cent. The author found that even after years, in some cases, the disease was still confined to one ear. Even with the most precise microscopic examination, the disease was found in only one ear. Ninety-five per cent of the patients complained of increasing deafness. The rate of progression differs greatly, a stationary period not infrequently occurring.

Tinnitus occurred in 68 per cent of the patients; vertigo was present in only 0.5 per cent; the ear drums were normal in 71 per cent and reddening of the promontory could be seen in only 20 per cent.

The author believes that the influence of pregnancy has been exaggerated. In 16.5 per cent pregnancy had not had a harmful effect, whereas in 46 per cent a change for the worse had been noted, but mostly after a number of births.

Otosclerosis. The term "otitis insidiosa" is preferred by W. S. Bryant[2]. The pathologic changes in the progressive, nonspecific deafness—otitis insidiosa—are all grouped under one heading: Degeneration. Each tissue is individual and invariable in its pathologic reaction, but there is variation due to the particular tissue affected at a particular period in the progress of the disease. The pathologic changes are nonspecific in character and may arise from a variety of causes.

(2) Ann. Otol., Rhin. & Laryng., March, 1928.

Predegenerative circulatory pathology, which later leads to degeneration, must be kept in mind, because at the onset of the disease these changes are the precursors of the later degenerative changes found in the cases of long standing.

In otitis insidiosa, all parts of the hearing mechanism are subject to attack. The pathology includes all variations that are found in chronic middle ear deafness that is not specific or suppurative in origin.

The etiology rests upon three points, namely, focal infection, endocrine dysfunction and hereditary tendency.

The focus of infection is usually located in the region of the pharynx, where the most important point is the pharyngeal bursa. Clinical experience proves that an activating factor in the form of a focal infection can act only on a ground previously weakened by defect of the endocrine system.

Endocrine deficiency is commonly in evidence, and various glands have been selected by various authors as especially blameworthy.

The pituitary is the chief defective link in the glandular system. This conclusion is supported and justified for the following reasons: (1) The pharyngeal pituitary, homologous with the cerebral pituitary in origin, is situated close to the pharyngeal bursa, which is the usual seat of the activating focal infection of otitis insidiosa. (Citelli, Poppi.) (2) The bony changes and other tissue changes of otitis insidiosa are identical with tissue changes known to be caused by a diseased pituitary. (3) The most common cause of exacerbations of otitis insidiosa is generally acknowledged to be pregnancy, during which time the cerebral pituitary is often abnormal. (Blohmke.) (4) The hereditary factor in the etiology of otitis insidiosa is a matter of general observation, and this hereditary tendency is further emphasized by the recognized heredity of endocrine derangement. (5) Much of the tinnitus accompanying otitis insidiosa is muscular in origin and is due to spasm

of the intratympanic muscles. These abnormal muscular contractions are doubtless caused in part by derangement of the pituitary in conjunction with the thyroid and parathyroid glands, since it has been observed that tetanic muscular movements follow the derangements of these glands.

Prophylaxis demands that special attention be paid to those individuals who have hereditary predisposition to progressive deafness, or who have a weak endocrine system or focal infection. We should at once remove the possible cause in predisposed individuals, especially in the patients who show a bad family history. The road open to the elimination of progressive deafness—otitis insidiosa—is not through the impossible dream of rejuvenation of lifeless, degenerated tissues, but along the sure and definitely indicated road of prophylaxis.

Treatment: When we recognize, in cases of otitis insidiosa, the etiologic factors and their sequence and interactivity, the aim and direction of the treatment are clearly and definitely indicated. All details of the treatment should be directed toward: (1) Elimination of the activating focus of infection; (2) Improvement of the endocrine function; (3) General constitutional treatment, as thorough as possible, and continued for an adequate period of time.

Major and minor operative procedures are required to remove all the foci of infection that can be removed, and local applications are needed for the treatment of the foci that cannot be removed surgically. Unsatisfactory results of treatment, as a rule, can be laid to the failure to remove the foci of infection. When the focus cannot be eliminated, it is necessary to continue treatment in order to hold in check the ear degenerative processes.

In cases of otitis insidiosa where no treatment is given, the hearing tends to decrease gradually between irregular remissions of more or less markedly rapid loss, until all useful hearing is completely lost. But approached

from a sound and reasonable etiologic point of view, an etiologic point of view that is thoroughly justified, otitis insidiosa need no longer have the hopeless prognosis which has been associated with it. Indeed, the prognosis in otitis insidiosa has, because of the more indefinite etiology and more intelligent direction and adaptation of treatment, become quite encouraging. The results of the treatment include arrest of the progress of deafness or at least a slowing down to an almost imperceptible deterioration, with complete cessation of remissions or exacerbations of the failing hearing. There is also an immediate improvement in the hearing level up to about the best reached during recent periods of intermission in the poor hearing. An important part of the prognosis depends on the ability to eliminate the activating focal infection, as well as to control the underlying endocrine deficiency.

A less optimistic part of the prognosis is the difficulty in eradicating the inherited and congenital defects. Also, the inability to completely restore the hearing function. The damaged degenerated tissues cannot of course, be replaced or restored. Prognosis depends also on the ability to guide and control the patient and keep him under observation long enough to follow up the treatment till all remission of the poor hearing have ceased for at least five years. Our point of view does not in any way guarantee that the intercurrent major physical accidents of life may not cause a recurrence of the process of otitis insidiosa in cases where it had completely ceased. This recurrence may be expected as the result of an endocrine catastrophe or a breakdown of normal resistance to bacterial infection. Since the fundamental activating cause cannot always be permanently eliminated, its baneful activity may be renewed under the influence of some great physical strain, such as child bearing, a general infection or the endocrine stress of emotional crises.

Pathology of Otosclerosis. By means of a series of

specimens O Mayer[3] believes he has demonstrated that in this disease the original bone of the labyrinth capsule became absorbed and bone-marrow was formed in which an excessive number of osteoblasts abounded. Thus there was formed new bone which was of imperfect character. The marrow spaces could be found occupied by large vessels. This new bone overgrew the oval window and the round window. The lesions in otosclerosis are multiple, and the multiple fibromata in other parts of the system must be regarded as manifestations of the same tendency. The author has found present in these cases a synchondrosis, and also bony growths in the petrous bone, represented by exostosis on its posterior aspect. Among 50 cases of deaf-mutism which he examined he found typical areas of otosclerosis in 20 per cent. In 15 out of 30 cases of otosclerosis he found some mal-development of the inner ear, and anomalies of the cochlear frame-work. That otosclerosis is a hereditary disease, is supported by the conditions found in the inner ear on pathological investigation. Indeed the disease affects the whole auditory apparatus, which shows a general tendency towards malformation. Mayer is convinced that the disease is not inflammatory, and equally sure that it involves connective tissue and bone—indeed, a hyperplasia.

In the discussion A. A. Gray expressed his agreement with nearly everything Mayer said, and added that his own view, based on a considerable study of the subject, was that the disease could only occur in a person who had a personal tendency or idiosyncracy towards the disease, though he did not think it was found to be hereditary in every case. In some instances bone was deposited in excess, while in others there was only absorption of bone. It was not only a disease of bone. He thought not only temporal bones should be investigated in inquiring further into this question, but also the brain.

(3) Lancet, June 9, 1928.

G. J. Jenkins spoke of the supposed association of the disease with osteitis deformans, remarking that in five cases of the latter disease which he had submitted to microscopical examination he had not found any of the bony changes which were characteristic of otosclerosis, from which he concluded that they were different diseases. He did not regard otosclerosis as atavistic; it was a progressive condition, and atavism was never progressive.

S. Hastings considered that Mayer's work on this subject was beyond all praise. He had seen cases of what he would describe clinically as middle-ear deafness change into typical otosclerosis. There was a tendency to conclude that because in the latter no active changes were detected, and no septic focus could be found in nose or nasopharynx, no such lesion had ever been present, the fact being that a process which was started by an inflammation might persist after the cause was removed.

Otosclerosis: Its Treatment. A. A. Gray[4] believes that the deafness of otosclerosis is due rather to the suspension of the function of the organ of hearing than to its actual destruction. The grounds for this belief are several. Bone conduction is often as good or better than normal. Some of the patients hear better in a noise (paracusis) than normal persons. In a large percentage of cases the hearing may be strikingly improved for a minute or two under certain circumstances. The author argues that if the deafness is due to ankylosis of the stapes, it could not momentarily be relieved by the inhalation of nitrite of amyl. He believes that such rapid physiologic changes could not take place in any structure other than the neurons concerned in the function of hearing. As the nerve impulse passes from the organ of Corti to the brain, it must pass through various synapses. It is in the

(4) J. Laryng. & Otol., January, 1928.

synapses that resistance to transmission is greatest and that the neurons are weakest.

The neurons of the vasomotor system, which control the blood supply to the organ of hearing, are also much concerned in the function of hearing. The writer has suggested in a previous work that otosclerosis is a degenerative process involving the organ of hearing as a whole, and it is his present intention to further develop this view. At birth a person is supplied with all the neurons he will ever possess. Any further elaboration in development depends on changes in the individual, not on their multiplication. At first, they are nonmedullated, and myelination only begins when the neuron commences to function, and it occurs later in proportion as the nerve fibre is more recent in the phylogenetic history of the animal. Development of the neuron continues until the prime of life—between the ages of 30 and 40 years. The neurons then remain stationary for several years; retrogression begins with old age. If the neurons concerned in the function of hearing have not the same inherent vitality as other neurons, they would show retrogressive changes earlier in life. This may not be uncommon, because the organ of hearing is of comparatively recent origin in evolution. As the synapse is the weakest spot of the neuron, the changes first appear there. The nerve impulses can no longer pass freely through the synapses, with the result that functional activity of the organ of hearing is impaired. Consequently, it requires a greater stimulus at the periphery (the organ of Corti), to overcome the increased resistance. This explanation may also account for paracusis and tinnitus.

When the organ of hearing is called on to function, its blood supply must be increased, and this increase is regulated by the neurons of the vasomotor system. If these neurons are defective, the tissues concerned must suffer, and the hearing will be lessened. The author believes that the blood supply to the soft tissues

would be sufficient to prevent any anatomic change. However, the effect on bony tissue would be harmful because there would be an impairment of the rapid cellular changes continually going on in bone. In the organ of hearing the most active bony region is in the anterior wall of the oval window, because here the movements of the stapes reach their greatest amplitude. It is exactly in this region that the bony changes in otosclerosis most often occur.

The author summarizes his belief that otosclerosis is a degenerative process resulting from an inherent defect in the neurons concerned in the function of hearing. This includes the neurons of the vasomotor system which regulate the blood supply of the organ, as well as those concerned in the transmission of nerve impulses from the organ of Corti to the brain.

Treatment.—Local treatment is entirely disappointing. The most important element is concerned with treatment of the patient as to general condition. The author has found that otosclerosis frequently makes its appearance in young women when they are suffering from chlorosis. The evil effects of pregnancy are well known. Any septic focus in the body has a bad effect on the course of otosclerosis. Exhaustion has a deleterious effect on the disease. Patients themselves remark that when they are tired hearing is worse. Tinnitis is much more severe after exhaustion. If the tinnitis is severe, recourse must be had to drugs. Barbital is more effective and not so depressing as the bromides. One large dose at bedtime is more effective than several small doses. The surgical treatment of otosclerosis has been rather unsatisfactory in the past. In conclusion, the author mentions that atrophic rhinitis may be explained on grounds similar to those given for the occurrence of otosclerosis, that is, an inherent defect in the neurons concerned. In atrophic rhinitis, there are the same diminished sensitiveness of the part, diminished secretion and failure of the vasomotor mecha-

nism to respond to irritation. The age incidence of the two diseases is approximately the same; they are commoner in women, and there is a hereditary factor in both.

Mastoiditis and Intracranial Complications

New Aid in Diagnosis of Mastoiditis. I. Friesner and S. Rosen[5] report examination of the calcium content of pus from the middle ear as a new aid in the diagnosis of mastoiditis. They give directions for chemical examination of the pus. They give, also, a statistical table of their own cases and hope that after further study by themselves and others, standards may be established which will help in determining the question of surgical interference.

A Routine Stereoroentgenographic Technic in Two or More Planes, for Simultaneous Viewing; Including the Study of the Mastoid Process. In any examination or consideration of any subject it is desirable to have all the available data, arranged in the relation or sequence of greatest convenience. This is especially imperative in any roentgen study which depends upon the comparison of two or more postures. Hence, the broad illuminating boxes universally used.

The necessity for discarding, even for a moment, one of a series to take up its counterpart, to be unable to view the two or more side by side, is always a handicap. Yet, this is the routine practice when stereo studies in more than one plane have been made. This handicap is only partially removed by the use of revolving illuminating boxes on the stereoscope, though these do greatly improve the situation.

As a result of their study D. R. Bowen and P. A. Bishop[6] have found that two or more stereoscopic pairs of roentgen films of a body part may be arranged for

(5) Arch. Otolaryng., April, 1928.
(6) Am. J. Roentgenol., July, 1928.

stereoscopic viewing, and then studied, with no more physical effort than that of shifting the vision from one to the other. This procedure is particularly desirable in the study of joint injury and the mastoid process.

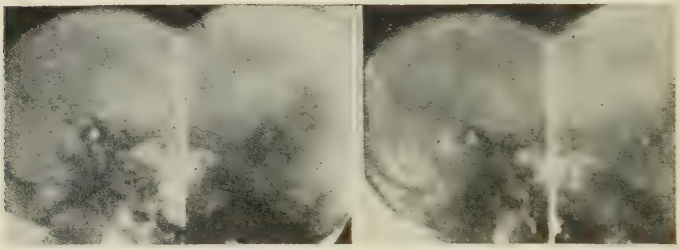

Fig. 38.—Roentgenograms of both mastoids ready for viewing as one pair.

A new instrument, film changing tunnel, is described; this for the convenient and accurate technic for these double stereoscopic studies.

A modification of classical positions for study of the mastoid process is offered.

The method includes an area around each mastoid sufficiently large to include all complicating lesions. (Fig. 38.)

Finally, it may be said that the procedure here set forth is no small part of a general improvement in exposure routine by which, with a constantly increasing number of patients to examine, the authors have been able to gradually reduce their expenditure for roentgen films for a period of upward of two years. At the same time all of these studies have been more full and complete than formerly.

Radiography in Mastoid Disease. From a study of the skiagraphs of over 500 cases, S. Young[7] believes that mastoids are normally symmetrical, and that usually

(7) Brit. M. J., Nov. 5, 1927.

they are pneumatic, occasionally diploëtic. He has found nothing to disprove Wittmack's views of the origin of the diploëtic mastoid.

Pneumatization proceeds in a more or less definite manner in children normally; mastoiditis, mild or severe, tends to arrest cell development, resulting in the persistence in adult life of a partially pneumatized mastoid process. If reinfected this arrested or infantile type of mastoid may develop a sclerotic character, and is probably more liable to chronicity.

A dense sclerosed mastoid has not been demonstrated without at least evidence of a preëxisting otitis media.

The Relation of Pregnancy to Mastoid Infections. A case of mastoiditis developing during three successive pregnancies is reported by H. A. Fletcher[8]. The patient had acute exacerbation of an old apparently healed mastoiditis in the first few weeks of her second pregnancy. The mastoid symptoms immediately became alarming, with fistula formation, and remained so until a spontaneous abortion took place, a week after radical mastoid operation. The wound healed in a reasonable time until, in the first two weeks of her next pregnancy, there was again an acute exacerbation with alarming symptoms. She was reoperated upon, but the mastoid did not heal until after the third operation, together with termination of labor by caesarean section eight months later. During this pregnancy her mastoid and head symptoms became increasingly worse until the time of her caesarean operation, after which mastoid and head symptoms again entirely disappeared and the mastoid wound healed, with the exception of one small area. Seven months later, in the first weeks of her next pregnancy (third), the ear again flared up with alarming symptoms, which cleared up immediately on termination of the pregnancy, and the mastoid wound healed and has been healed for six months. The author reported the case briefly at the California State meet-

(8) Ann. Otol., Rhin. & Laryng., December, 1928.

ing in 1925. Since then this patient has had one short period of pregnancy, terminated after two months by a self-induced abortion followed by a severe pelvic inflammatory process, which later necessitated a total hysterectomy. During this last pregnancy the ear symptoms were beginning to arise, but the mastoid had not broken down when abortion was brought on.

Fletcher believes that pregnancy as such is not the cause of these conditions, but that every pregnant woman is carrying an extra load. Some can carry the pregnancy and in addition infections, nephritis, tuberculosis. Others cannot carry even the pregnancy alone. That tuberculosis itself might be a factor in some of these cases was suggested in the discussion on Bondy and Neumann's cases, but this was ruled out in the author's case by microscopic examination and guinea-pig inoculation. If a patient has a progressing infection with her pregnancy she is carrying two loads, and if we may not remove the one load before it reaches the danger zone then we must sacrifice the other.

The Conservative Mastoid Operation. C. J. Heath[9] emphasizes the point that the Schwartze operation for acute mastoiditis is not infrequently followed by recurrences of the acute condition, which are dangerous because this operation does not provide for permanent outward drainage of the antrum. After the Schwartze operation the wound is left open and disfigurement results.

The inaccessibility of the mastoid antrum is responsible for danger, and even loss of life, in recurrences after the Schwartze operation, because it does not secure that severance of the mastoid antrum from the middle ear, which is an essential feature of the author's operation. He ensures that the antrum—through the complete destruction of its lining mucosa—shall permanently cease to be a mucus-secreting cavity draining inwards through a very narrow channel into the middle

(9) Lancet, Feb. 11, 1928.

ear; that it shall be severed from all connection with the middle ear; that it shall open widely outwards, and become part and parcel of an enlarged and dry external auditory meatus, widely open to the air, so that discharge cannot possibly be pent up. This constitutes a complete physiological change in the function of this dangerous, mucus-secreting cavity, and necessitates a surgical rearrangement of the hinder end of the middle ear. This rearrangement has a double purpose; (1) ensuring the immediate and future safety of the patient's life, and (2) arresting the septic antral discharge and resulting tympanic destruction, in order to save the hearing. The procedure entails the removal of nearly the whole front wall of the antrum, so that it is as widely open and as easily visible and accessible as the meatus itself. It is because the tiny antrum is embedded in bone in a dangerous locality and therefore cannot, like the cecal appendix, be completely removed, that the author devised this method of rendering it permanently safe.

Aural surgery is proverbially unsuccessful in saving the hearing, and it is important that the reason for this should be widely known, that nearly all mastoid operations are performed much too late—that is to say, after the hearing apparatus has been ruined by disease. This deplorable state of things usually arises from inability to diagnose the tympanic conditions; this is not surprising, since the necessary information is not given in any text-book. The surgeon who cannot diagnose these conditions cannot possibly know when he ought to operate to save the hearing. While he waits hearing is lost beyond recovery. It is in this disastrous condition of lost hearing from neglecting to operate when the hearing is endangered that most of the children are sent to the Downs Hospital for operation, and in consequence of this a large majority of the mastoid operations performed there are by Stacke's "radical" method. This operation may put an end to disease and danger, but it does not save the hearing; it was not devised or in-

tended for that purpose. If these children are sent to the hospital in time to save their hearing they all undergo operation by the conservative method. Last year no more than 105 cases were admitted for the Heath operation, whereas 267 Stacke's radical operations were necessary. As this entails removal of the drum-head and ossicles, permanently defective hearing in a large majority of those children was the inevitable result.

The author has persistently condemned the prolonged treatment of suppurating ears by syringing and drops, and the treatment by ionization, now in vogue, is little if any, more effective. Thousands of the children who are being thus treated will never hear properly again; the disease has been allowed to exist too long. With few exceptions the longer the disease lasts the more damage is done to the hearing. Persistent suppuration in any situation is destructive, and it is especially so in the tiny channels of the ear.

Short of a conservative mastoid operation the earliest possible removal of adenoids offers far the best prospect of curing a suppurating ear. Attendance as an outpatient at a hospital or school clinic, for the treatment of a chronically discharging ear, is usually a waste of time and, through the delay in admission for operation, often results in the loss of hearing. Destruction of the ear through chronic suppuration is sometimes very rapid and, as pain may be absent, it may not attract attention.

After introduction of the conservative operation at the Throat Hospital the author performed 360 mastoid operations there with only one death; most of these were cases of acute mastoiditis arising in ears that had long been diseased, for which Stacke's radical operation had been previously designed and used. The average duration of the disease in these 360 patients was six years. The long delay was mainly due to lack of beds; but even six weeks is far too long to delay operation if perfect restoration of the hearing is to be made probable. These statistics indicate that a mastoid operation should

not in itself be dangerous, though the conditions which call for it often are.

The characteristics of the three mastoid operations can be briefly summed up and compared.

(1) Schwartze's "simple" operation was devised as an emergency measure for use in early acute disease to save the patient's life. It is unsatisfactory, mainly because it was not designed to ensure the future safety of the patient. It has, moreover, many other very serious drawbacks.

(2) Stacke's radical operation was also not devised for saving the hearing, but for curing chronic disease, or acute mastoiditis arising in chronic cases—i. e., it also is life-saving, for the future as well as the immediate present. Nevertheless, it is unsatisfactory, entailing as it does the removal of the drum-head and ossicles, and rendering the hearing permanently defective.

(3) The author's method, the conservative operation, besides being life-saving, immediate and remote, is the only one of the three which is designed to preserve the hearing. These twofold advantages are only rendered possible by the physiological change brought about in the function of the mastoid antrum—the distinctive and outstanding feature of the operation.

If the hearing of the persistently discharging ear is to be made and kept safe the only effective and permanent remedy available is a timely conservative mastoid operation—i. e., one which is performed in time to arrest the disease before it has ruined the ear.

Mastoidectomy. L. H. Schwartz[1] favors early and thorough incision in acute purulent otitis media but believes that mastoid exenteration is rarely if ever required. In postauricular abscess he favors simple incision. A case is reported which recovered without operation when the symptoms seemed to point toward the necessity of operative interference. [Experience has much to do with one's opinion regarding the advisability of

(1) Arch. Otolaryng., October, 1927.

operating in a given case or a class of cases. When the otologist has seen several disastrous results from waiting for the child to recover without operation (meningitis, sinus thrombosis, etc.) he is likely to conclude that mastoidectomy is a conservative procedure.—Ed.]

Radical Mastoid Operation. L. E. White[2] considers that a radical operation on the mastoid is successful when it prevents intracranial infection, stops or lessens discharge from the ear and offensive odor, relieves headaches and dizziness, and preserves the hearing.

In 57 of 100 cases the cavities were dry and well epidermitized at the time of observation. This number far exceeded the commonly accepted idea of successful operations. In 22 cases the cavities were moist and needed attention. Twenty-one patients had granulations, and the discharge was profuse. It was lessened by the use of solution M (boric acid, 20 gr.—1.3 gm.—and alcohol, 1 ounce—30 c. c.), and the patients were advised to return regularly for local treatment or removal of the granulations. The results of the tests of hearing were indeed discouraging. Only 37 patients had improved in various degrees.

In the majority of cases, headache and dizziness were relieved. Forty-five patients had headaches, 38 were relieved and 7 not. Fifty-five patients had dizziness, 39 were relieved and 16 were not.

Complications were few. Two patients had a serious labyrinthitis. The author tabulates the results of the tests of hearing in the right ear of one patient and in the left ear of another.

Only 3 of 100 patients had facial paralysis, and only 1 case occurred postoperatively. All these patients recovered. One exploration was performed for abscess of the brain; there were 2 cases of erysipelas, 2 of sinus thrombosis, 1 of meningitis which was considered secondary to abscess of the brain and in which the spinal

(2) Arch. Otolaryng., July, 1928.

fluid was sterile, 1 of fistula of the horizontal canal and one of surgical shock.

Fifty-seven of the radical operations were completely successful, and the rest resulted in a decided lessening of discharge and odor. Only 3 patients in the entire series had intracranial complications, 1 had meningitis and 2 had serous labyrinthitis.

Improved hearing occurred in 37 cases; the hearing was unchanged in 14 and lost in 49.

Complete failures occurred in all cases in which a discharge had been present for less than a year. The most favorable results were obtained in cases in which a discharge had been present for less than fifteen years and for more than five years.

The choice of methods of skin graft is unimportant. Primary and secondary skin grafts alike resulted in about 50 per cent good cavities; in cases in which skin grafts were not employed, the results were equally successful. The method employing the paraffin basket was the most successful, with good results in three-fourths of the cases.

The period of hospitalization averaged from four to five weeks.

Hypertrophy of the turbinates had little bearing on the end-results. Tonsillectomy was beneficial.

Thirty-eight of the 45 patients who suffered from headaches were relieved, and 39 of the 55 who were subject to dizziness, were relieved.

The accumulation of this material has accomplished three purposes beneficial to the patient: (1) Patients were seen in the clinic in whom the results of the radical operation were excellent, though the cavity was filled with cerumen. (2) Patients returned who were greatly in need of local treatment, because of moist cavities from small granulations. (3) Patients in whom it was necessary to remove a large mass of granulations, probably under an anesthetic, were advised to have this done.

The Development of Complications in Different Forms of Acute Inflammation of the Middle Ear. The results of the investigations of Krainz, which seemed to contradict the observations made by Scheibe in 1904, caused W. Brock[3] to undertake a similar study. The author did not confine himself to cases of genuine otitis as Krainz did, apparently, but he examined the cases as they occurred. In the 32 cases of acute otitis media which the author examined, 39 complications were found, namely, 26 complications among 23 genuine cases and 13 complications among 8 cases of otitis after grip. Of the 26 complications in genuine cases, 22 (84.6 per cent) had developed through fistular perforation of an empyema and 4 (15.4 per cent) along dilated marrow spaces that were infiltrated by inflammation. Empyema was not always present. Of the 13 complications in cases of grip, 11 (84.6 per cent) were caused by fistular perforation of an empyema and 2 (15.4 per cent) through propagation along dilated marrow and vessel spaces without empyema.

Taking in consideration also the results of Otto Mayer in his cases of otitis media acutissima, the author states that the infection extends beyond the spaces of the middle ear in the following ways: (1) Pus wanders into the adjacent tissue through fistular perforation of an empyema, namely, of pus under pressure. This modus operandi is by far the most common; 84.6 per cent of all complications in genuine cases and the same percentage in cases of grip developed in this manner. (2) Infection occurs by propagation through marrow or vessel connections, namely, (*a*) along normal vessels and marrow spaces (cases of otitis media acutissima—rare and not observed by the author); (*b*) along marrow and vessel connections which have existed previously or which have been created through the inflammatory process, but which have been enlarged by action of the osteoclasts. This can occur with or without empyema. This mode of

(3) Ztschr. f. Laryng., Rhin., February, 1928.

complication could be established in 15.4 per cent of the genuine cases and in the cases of grip. In the same manner, the complications occurred in a case of diabetes.

The author speaks of 4 cases of Otto Mayer in which the patient came to operation on the third and fourth day after the start of the infection of the ear on account of the grave general symptoms, stupor and violent pain. A severe purulent and hemorrhagic purulent inflammation was found. In some a small perisinus abscess was present. Histologic examination in these 4 cases showed: (1) purulent hemorrhagic exudation into the mucous membrane, into the pneumatic cells and vessel channels and into the marrow spaces; (2) enormous dilatation of the blood vessels in the mucous membrane of the cells and of the bone, partly with thrombosis of the vessels and perivascular infiltration; (3) slight osteoclasis in the vessel channels, and (4) formation of osteoid borders in the walls of the pneumatic cells.

The Complications of Suppurative Middle Ear Disease. From his experience H. L. Pollock[4] believes that in cases of acute otitis with mastoid complication it is safer usually to wait three weeks than to operate in four days. Exceptions to this rule do occur, however, and should, of course, be attended to. If clinical experience shows that a mastoid must be opened, laboratory findings may be altogether ignored.

When a case is complicated by a chill and rise of temperature, the author feels that it is foolish to operate unless a second rise in temperature occurs. At operation, if a pulsating, healthy-looking sinus is found, it is best to leave well enough alone; also, where the sinus is covered with granulations, these should not be removed. To determine the presence or absence of a thrombus the writer advises a small incision. A needle may go through a mural clot and cause blood to be withdrawn, giving rise to a false diagnosis. When a clot is found it should be cleaned out thoroughly and free bleed-

(4) Illinois Med. J., June, 1928.

ing obtained from both ends, if possible. The jugular may be ligated or not, depending on the judgment of the operator. The author is not in favor of ligation before the sinus is inspected.

Where a labyrinthitis has developed it is very poor policy to operate on the labyrinth immediately. It is always wise to wait seven to ten days before doing anything surgically, even on the mastoid. But if the condition continues and develops into meningitis it is very serious, and nothing is lost by operating immediately. Otitic meningitis is practically always fatal.

Extradural abscess is not usually difficult to determine at operation, but cerebral or cerebellar abscesses are at times quite difficult.

Frequency of Otitic Complications of the Brain. The statistics in this article by K. Ruegg[5] are based on 27,899 reports of necropsies from the pathologic institute at Basel, from 1872 to 1927; on the histories from the ear clinic from 1897 to 1927 (3,175 acute and chronic cases of otitis, and 339 cases of otogenous intracranial complications), and on the annual reports of the university policlinic from 1897 to 1927 (56,324 patients with diseased conditions of the ears, among whom there were 25,203 with acute or chronic otitis).

1. An intracranial complication was the direct cause of death in 112 of 27,899 patients who came to necropsy in the pathologic institute, in 0.42 per cent.

2. Of 56,324 patients seen in the policlinic suffering from various diseases of the ears, 86 died in consequence of the ear trouble, 0.15 per cent.

3. Of 28,378 patients suffering from an acute and chronic otitis media, 86 died, 0.3 per cent.

4. Of 339 patients suffering from intracranial otogenous complications, the complication was solitary in 265 (78.2 per cent); and in 74 patients (21.8 per cent) there were simultaneously 2, or exceptionally more, intracranial complications. Among 422 otogenous intracranial

(5) Ztschr. f. Hals-, Nasen- u. Ohrenh., Dec. 22, 1927.

complications (in 339 patients), 251 extradural abscesses were found (225 in the posterior cranial fossa, 11 in the middle cranial fossa and 15 in both). Sinus phlebitis was found 81 times (among 422 complications), meningitis 62 times and abscesses of the brain 28 times.

5. In 27,899 necropsies, abscess of the brain was found in 104 instances (0.37 per cent). In 32 of the 104 patients (30.8 per cent), the abscess of the brain originated in the ear. Of 32 abscesses of the brain, 16 were found in the cerebrum, 14 in the cerebellum and 2 in both.

Otogenous abscess of the brain was almost always solitary, whereas in non-otogenous abscesses one not infrequently finds two or more foci separated from one another. Of 32 otogenous abscesses of the brain, 29 were solitary; in 2 instances there was a combination of an abscess of the cerebellum and the cerebrum, and once multiple cerebellar abscesses were found. Of 72 nonotogenous abscesses, 46 were solitary and 26 multiple abscesses. In 27,899 necropsies, 129 cases of sinus phlebitis were found (0.4 per cent); of these, 51 cases (39.5 per cent) were otogenous. In the same number of necropsies 1,141 cases of meningitis presented themselves (4.1 per cent); only 74 were of otogenous origin. Tuberculosis was the cause of death in 759 cases (66.5 per cent). In 42 of the 74 cases (56.8 per cent), only meningitis was present.

6. Acute and chronic otitis and the various intracranial complications were more prevalent in the male.

7. Acute and chronic otitis and complications were found more frequently in the three first decades. Abscess of the brain was rare during the first decade.

8. Extradural abscesses were more frequent in cases of acute otitis. Acute otitis was present in 160 (80.5 per cent) of 200 cases, whereas abscess of the brain developed more frequently in cases of chronic otitis (18 of 28). Otogenous sinus thrombosis occurred 43 times with acute otitis and 38 times with chronic otitis; sup-

purative meningitis occurred 16 times with acute otitis and 14 times with chronic otitis.

Bacteriologic examination of pus taken from the mastoid process in endocranial complications revealed mostly streptococci and pneumococci.

9. Of 3,176 cases of otitis in the clinic, 42.3 per cent were on the right and 40.3 per cent on the left side, whereas 17.4 per cent were bilateral. Intracranial complications were also equally divided as to location.

New Methods for the Early and Differential Diagnosis of Intracranial Complications. Bruenings'[6] theory of intracranial pressure is that the volume of the brain and spinal marrow is less than the bony cavities containing them and that this space is filled by the cerebrospinal fluid. The brain, the spinal marrow and the cerebrospinal fluid are incompressible. The only compcompressible contents are the venous plexuses. The elasticity of these keeps the intraneranial pressure at an average of about 20 cm. water column. If puncture is performed, the liquor flows out but ceases at the moment the pressure reaches 0. Up to this point, the author calls it the spontaneous flow. If venous pressure is raised by compression of the jugular veins, causing increased pressure in the venous plexuses, more fluid is forced out until the balance of pressure is again reached. This he calls pressure flow quantity. That which remains behind is the residual liquor.

There are three types of increased pressure: (1) That due to an increased quantity of liquor. In terms of the water manometer, the highest recorded pressures are: 80 cm. from a pathologic condition and 200 cm. under experimental conditions. (2) Pathologic and experimental pressure. The highest record by jugular and possibly abdominal pressure also is 75 cm. (3) Permanent pressure, which is due to increased volume of the brain or narrowing of the cranial shell. So far his highest record is 85 cm. (tumor of the brain).

(6) Ztschr. f. Hals-, Nasen- u. Ohrenh., 1927—1928.

In the absence of pathologic changes, a pressure increase of 75 or 80 cm. by venous pressure does not cause headache or vomiting. If the pressure is increased to 130 or 200 an increased blood pressure suddenly appears to prevent anemia of the brain. These patients also show progressive paresthesia and later clonic convulsions, which may last some time after the pressure is released. The author has never seen continued headache. The well known headache accompanying intracranial pressure must be due to causes other than the pressure.

Bruenings states that it should be possible by jugular compression to distinguish between intracranial and extracranial causes of headache. In intracranial headache this method should distinguish between organic and functional causes. It is possible that the test will cause headache in intracranial lesions when spontaneous headache does not yet exist.

The author has experimented with headaches caused by diseases of the ear and those caused by diseases of the sinus and so far they were not increased by this pressure in any case. Positive reactions were obtained in all cases of leptomeningitis and painful brain tumors, in patients with toxic neuritides, i. e., postnarcosis headache, alcoholic headache and the prodromal headache of general infections. Negative reactions were obtained with extra dural abscess, sinus thrombosis, migraine and traumatic-neurotic and neurotic headaches.

Diagnosis of Lateral-Sinus Infection. According to G. L. Tobey[7] definite diagnosis of sinus thrombosis is often very difficult. This is especially true in those cases where the middle-ear infection is so slight as to cause little or no comment. In reviewing the various points in diagnosis the author stresses and describes in detail the Ayer manometric test, which he believes is of the greatest value.

The test is based upon the fact that increased intracranial pressure is normally propagated throughout the

(7) Atlantic M. J., September, 1927.

cerebrospinal-fluid system and may be measured by a manometer employed in connection with lumbar puncture. Compression of the internal jugular veins causes increased intracranial pressure, with immediate rise in spinal-fluid pressure.

The technic is as follows: With the patient in the lateral position, lumbar puncture is performed, and the fluid is allowed to run into a glass manometer of 2 mm. bore. The initial pressure reading is noted; also the presence of pulse and respiratory oscillations as evidence of patency of the manometric system. Now, without in any way disturbing the patient, an assistant gently presses on one side of the neck between the larynx and the sternocleidomastoid muscle until he feels a strong carotid-arterial pulsation. During the compression, the operator watches the rapidity of rise of the fluid column in the manometer, the promptness of its beginning, and the full height to which it attains, and, on release of the jugular compression, the rapidity of drop in pressure. The procedure is now repeated on the opposite side of the neck, and then for comparison, both sides of the neck are pressed simultaneously.

In a typical case of lateral-sinus thrombosis there is a prompt and rapid rise in fluid pressure to twice or three times the initial reading when the internal jugular vein draining the normal sinus is compressed. This pressure rise is maximal, being equivalent to the pressure attained when both jugular veins are compressed. Pressure over the vein draining the thrombosed lateral sinus causes either no rise or more commonly a slow rise of only 10 to 20 mm. in the manometer.

These findings are characteristic of complete obliteration of the sinus. Partial obstruction from mural thrombosis naturally gives less striking results, yet results of value when correlated with clinical findings.

Some of the pitfalls of the technic as encountered in the study of a large number of cases are:

1. Incomplete compression of the jugular vein as the

result of faulty technic in applying compression accurately, as a result of obesity, tumors, cervical adenitis, or phlegm.

2. Absence of rise in fluid pressure or very slight rise is occasionally noted in patients with no obstruction either in the venous or in the subarachnoid fluid systems, when the cerebrospinal fluid is under low tension. This can easily be proved in a given case by injecting from 10 to 20 c. c. of physiologic sodium-chlorid solution, whereupon dynamic tests will appear normal.

3. An abnormal rise in fluid pressure may result from carelessness in performing the test, or from extraneous acts on the part of the patient. If the patient coughs, holds his breath, grunts, or even moves his head or body, a prompt rise in pressure will be noted under normal or abnormal conditions, thus vitiating any record.

4. Normal difference on the two sides. The foregoing pitfalls concern bilateral as well as unilateral venous compression. There is often a marked difference in the height of the pressure reading following compression of each internal jugular vein separately. However, a difference of over 50 mm. is unusual and over 100 mm. exceptional. Given a normal initial spinal-fluid pressure (150 mm.), the rise on jugular compression of one side usually will be ample, seldom less than 50 mm., more likely over 100 mm. The rise in fluid pressure appears to be somewhat less when the vein on the dependent side is compressed. It is likely that this is an error in technic due to difficulty in reaching this vein rather than an inherent difference in physiology.

5. Anatomic variation in the size of the lateral sinuses must be admitted, although a demonstrable difference in the size of the two lateral sinuses is unusual. One must, therefore, admit a certain irregularity in the anatomic disposition of the tributaries of the internal jugular vein, variations of the facial vein being of greatest significance in this test. It is probable that the slight rise frequently observed on compression of the jugular vein

on the side of complete sinus thrombosis is to be explained by coincident compression causing stasis in the ophthalmic venous system.

The possibility of two known dangers must be admitted in the use of this test: (1) sudden death from the presence of subtentorial abscess or tumor following lumbar puncture, and (2) the precipitation of acute meningitis.

The first danger may almost be eliminated by a careful examination of the patient. If the neurologic examination suggests the presence of abscess or tumor, but especially if choked disks are found, the well-known danger of medullary paralysis following lumbar puncture must be entertained. In such patients the spinal-fluid tests should not be attempted.

The second possible danger relates to the liberation of organisms from an area of localized infection or from the blood stream. The former appears to be unlikely unless large amounts of fluid are withdrawn. But the latter danger rests on experimental evidence in which it was shown that in the presence of blood infection passage of organisms from vessels to meninges may be facilitated by withdrawal of cerebro-spinal fluid, or by cerebral venous congestion. Although recognizing this is a biologic principle, the author has so far failed to note this serious coincidence clinically.

Differential Jugular Blood Cultures in Sinus Thrombosis. Since making a preliminary report R. Ottenberg[8] has used his procedure in 11 more cases, making a total of 15 cases so treated.

The principle of the procedure consists in aspirating blood simultaneously from the two internal jugular veins, carefully plating it out in petri dishes of nutrient agar, and comparing the number of colonies of bacteria per cubic centimeter of blood obtained from the two sides. In a case of otitic infection, a very marked difference in the number of micro-organisms in the two

(8) J. A. M. A., May 19, 1928.

sides is regarded as evidence of thrombus on one lateral sinus or the other.

Of the 15 cases, the cultures were done in 14 because sinus thrombosis was suspected, and in 1 case, an instance of bacterial endocarditis, the culture was done purely to control the technic.

Eight cases were proved at operation to be sinus thrombosis; of these, 1 gave sterile blood in both jugular veins (case 6); 2 gave small and approximately equal numbers of colonies from both veins (cases 5 and 8), and 5 showed very pronounced differences in the numbers on the two sides. Of the 7 remaining cases, 1, believed to be thrombosis of the lateral and cavernous sinuses, showed a very marked difference in number of colonies between the two sides but the disease could not be determined by operation or at autopsy (case 9). Another (case 10), clinically believed to be a cavernous sinus thrombosis and meningitis complicating a mastoid infection, showed almost equal numbers of bacteria on the two sides. In this case also autopsy could not be obtained. Four cases in which sinus thrombosis was suspected but in which negative blood cultures were obtained from both veins were subsequently proved not to be sinus thrombosis (2 by operation and 2 by spontaneous recovery).

The important observation was that of the 5 cases of sinus thrombosis which showed a great disproportion between the numbers of bacteria on the two sides, 4 cases showed the larger number of bacteria in the jugular vein of the normal side, and the smaller number in that of the diseased side (cases 1, 2, 3 and 4). In these cases, the thrombus was found to be an occluding one. In the 1 case in which the large number was found on the diseased side, the thrombus was mural and nonocclusive (case 7).

These rather unexpected facts enable one to form a picture of what happens when a mastoid infection spreads to the lateral sinus. At first the phlebitis results in the laying down of a superficial layer of thrombus

within the vein, and the blood current rushing past this carries bacteria from the thrombus down in the internal jugular vein of the same side. If bacteria are being given off rapidly, the number of bacteria per cubic centimeter of blood will be greater in this vein than in the opposite jugular vein or in other peripheral veins (as in case 7) since, of course, as is known, bacteria are quickly killed off in the blood stream or filtered out in the organs. If bacteria are being given off slowly (and killed rapidly), one will expect only small numbers on both sides and no great difference between the two sides (case 8). If bacteria are being killed slowly in the blood stream, as happens when the body is overwhelmed with infection, the numbers in the two veins and the periphery will be large and approximately equal (possibly case 10; but the diagnosis in this case is unverified).

On the other hand, when the thrombus becomes large enough to occlude the vessel, the venous blood from the corresponding half of the cranial cavity can no longer get out through the lateral sinus and jugular vein of the diseased side; the current is reversed, and drainage finds its way via the torcular herophili and other venous anastomoses into the lateral sinus and jugular vein of the healthy side, as shown in the accompanying diagram. In four such cases (1, 2, 3 and 4) in which there was a decided difference in the number of bacteria on the two sides, the larger number was found in the vein of the healthy side. Naturally here also, if the bacteria are being given off but slowly by the thrombus, one cannot expect a difference between the two sides (case 5).

Whether the reversal of blood current is the full explanation of this finding or whether in a larger series of cases this finding will remain invariable cannot yet be stated. Experience has shown that the spread of a thrombus downward almost never goes farther than the jugular bulb, while the spread upward in the lateral sinus has no definite limit. Probably the lower end of

the thrombus is the one which forms first and therefore becomes sterilized first.

Prevention and Minor Symptoms of Sinus Thrombosis. R. Almour[9] believes that too little emphasis is placed on the clinical picture presented by the patient. Otologists have come to view certain signs and symptoms as "suggestive" of sinus thrombosis rather than *diagnostic.* It is unfortunate that the rapid progress in the development of laboratory medicine has to a certain extent dimmed the clinical sense of the otologist. Too many depend on the laboratory diagnosis of sepsis as evidenced by a growth of bacteria on culture of the blood.

The clear-cut picture of a sinus thrombosis is known. It is a definite picture of sepsis, with chills, sweats and septic temperature; often metastatic abscesses appear. This picture differs in no way from that of a sepsis due to other causes. The source of the venous sepsis and its diagnosis is dependent on the *situation of the primary lesion in the mastoid process or some other portion of the temporal bone.* When such a picture is presented following a mastoidal infection, even the beginner in medicine recognizes its significance.

On the other hand, when the sepsis assumes a course which varies from the usual concise picture, the minor symptoms, which are always insignificant, become the guides. It is probably because otologists are accustomed to see the majority of cases of sinus thrombosis present a typical sepsis that the significance of the minor symptoms are overlooked. In brief, they are: headache, papilledema, appearance of well-being, and overlooked initial chill and a persistent polymorphonucleosis following removal of the mastoidal suppuration.

Headache is an important symptom in sinus thrombosis. Phillips stressed its importance in this connection. Most of the patients with mastoiditis who have been operated on complain of pain over the area operated on,

(9) Arch. Otolaryng., October, 1927.

and some interpret this as headache. On the other hand, when such patients complain of a persistent dull ache over the entire side, associated with a heavy feeling in the head, it is significant of a disturbed venous circulation. A patient having a sinus thrombosis has a peculiar septic flush, which gives one the impression of overstimulation. The eyes are bright and the patient feels well and active.

Many patients who have a flat temperature throughout the course of sinus thrombosis, will, on closer analysis, be seen to have a slight chill with a rise in temperature sometimes no higher than 102 F.; the temperature then returns to normal and remains so.

A high leukocyte count with a high polymorphonuclear percentage which persists after the removal of the infection in the mastoid process, should lead one to suspect the presence of an undiscovered suppuration in the wound, when all other causes for the leukocytosis have been eliminated. When the polymorphonucleosis is associated with headache over the side operated on it is significant of sinus thrombosis.

When a papilledema of the optic nerve is noted on the same side as the mastoiditis, it is diagnostic of an interference with the blood supply in the lateral sinus. The blood in the petrosals is dammed back into the cavernous sinus, and the vessels of the optic nerve become engorged, producing an edema of the nerve.

He offers the following summary: (1) When, at the primary operation on the mastoid process, an extensive pathologic process is found to involve the lateral sinus wall, an obliteration of the entire sigmoid sinus and removal of the involved portion will greatly lessen the incidence of a subsequent otitic sepsis.

2. The presence of a lateral sinus thrombosis may not give the typical picture of sepsis.

3. The presence of unilateral headache, persistent polymorphonucleosis, papilledema, appearance of well-being and an overlooked initial chill favor the diagnosis

of sinus thrombosis when they are noted following an operation on the mastoid.

4. In a case which is clinically one of sinus thrombosis one should never depend entirely on the results of blood culture for the diagnosis of sinus thrombosis; nor should one postpone operation until the result of the blood culture is ascertained.

Involvement of Blood Stream in Otitic Disease. H. I. Lillie[1] reports five cases of lateral sinus disease. In diagnosis he considers blood culture more important than the leukocyte count.

1. Whether the sinus need be ablated and the jugular vein tied in cases with infection in the blood stream originating in the temporal bone at the time of the original mastoid operation will depend on the type of disease, the physical condition of the patient and the judgment of the aural surgeon.

2. In certain cases with early involvement of the blood stream removal of the diseased bone and sufficient exposure of the sinus wall will control the disease.

3. Little real harm to the patient can result from conservative measures if cases are well chosen.

4. Blood culture is the most important laboratory aid to diagnosis.

5. Blood transfusion with the addition of gentian violet or mercurochrome is beneficial. At least a supportive effect and perhaps a definite therapeutic effect may be expected.

6. The general appearance of the patient following operation is a fairly satisfactory index of the physical condition, and this will obviate annoying the patient with unnecessary laboratory tests.

7. All cases of acute otitis media should be closely observed.

8. Early mastoid operation is not indicated in all cases of otitis media without definite physical evidence of surgical mastoiditis, but is demanded in cases in which

(1) Ann. Otol., Rhin. & Laryng., March, 1928.

there is evidence of extension of the infection through the mastoid to the blood stream.

General Sepsis of Otitic Origin. From the study of a small group of cases (12), H. I. Lillie[2] feels that it is difficult to evaluate accurately the beneficial effect of blood transfusion or of blood transfusion combined with intravenous injection of a germicidal dye. The effect on the temperature seems graphic enough, and the general effect on the patient's condition is also definite but not readily put into words. He is not prepared to say whether the combined method or blood transfusion alone is preferable, as the patients in whom blood transfusion alone was used seemed to do as well as the others.

The author particularly emphasizes the fact that more reliance may be placed on well directed surgical intervention than on either blood transfusion or the combined method, but as adjunct therapeutic measures great benefit may be derived from them. In other words, from our present knowledge it can be said that surgical treatment is not supplanted by either of these methods.

Untoward results have been reported from the use of the methods described, but the danger may be reduced to the minimum if the services of an expert hematologist or biochemist are always utilized. Interns and house officers, as a rule, are not sufficiently experienced in the use of these specialized therapeutic measures.

The author's experience with blood transfusion and germicidal dye, and the reports of others, convince him that their use as an adjunct therapeutic measure is rational if the cases are properly chosen and the agents properly prepared and administered. The supportive effect of blood transfusion is to shorten convalescence; the germicidal dye is a curative measure. While not defending or advocating the use of the measure, he is merely reporting his impressions from observation of its use. He feels that the measure has its place in the management of sepsis of otitic origin.

(2) Arch. Otolaryng., January, 1928.

Primary Jugular Bulb Thrombosis. This term is restricted by J. L. Maybaum and I. B. Goldman[3] to cases of an infected thrombus in the dome of the jugular bulb, the lateral and sigmoid sinus not being affected by the thrombosis in the initial stages. The condition occurs usually in young children.

The authors summarize the findings in their nine cases as follows:

Aural History:	Cases
Bilateral middle ear suppuration	1
Acute purulent otitis media:	7
Acute otitis media (no otorrhea):	1
Chronic purulent otitis media:	1
Central perforation:	1
Mild acute exacerbation:	1
Type: Mild. Recent acute otitis media or resolving—	
History of repeated attacks of acute otitis media:	7

General Symptoms:	Cases	Ocular Fundi	Cases
Chills	4	Optic neuritis early to advancing	3
Septic temperature	9	Papillo-edema	2
Headache	3		
Vomiting	2		
Spleen enlarged	3		
Liver enlarged	3		
Cervical glands enlarged and tender	4		
Cutaneous (macula-papular and postular)	5		
Operative Findings:			
Acellular (sclerosed)	8		
Mastoid cells (not involved)	1		
Sinus plate: intact	9		
Sinus wall: diseased	9		
Sinus contents: purulent obturating thrombus	7		
fluid pus	1		
thrombus not demonstrable	1		
bulb absent bleeding	8		
torcular: No bleeding	2		
torcular: Yes bleeding	4		
torcular: Doubtful	3	(Free bleeding from superior petrosal)	

(3) Laryngoscope, September 1928.

POST-OPERATIVE COURSE

METASTASES AND COMPLICATIONS:

Five cases:
- Tempero-sphenoidal abscess 1
- Pulmonary: Bilateral embolic process 1
- Joints and soft parts 3
- Sympathetic meningitis 1

Fundi: post-operative:
- Four—negative
- Five—increased changes and then recession to normal

Outcome: Eight cases recovered. One ceased.

In conclusion the writers state that.

(1) A mild middle ear infection in young children, associated with a septic temperature otherwise unaccounted for, suggests the possibility of a primary jugular bulb thrombosis. (2) For a favorable outcome, early diagnosis and prompt surgical interference, properly directed, is imperative. (3) Blood culture studies of Libman and more recently of Ottenberg materially aid in the diagnosis. (4) Occlusion of the main channels of systemic invasion, especially the torcular end of the diseased sinus, as suggested by Ottenberg's differential blood cultures studies, is of prime importance. (5) A jugular bulb operation should be performed only if there is a continuance of bacteremia and symptoms, general and local, after the main channels have been obliterated. Extensive jugular bulb operations are seldom indicated.

Otitic Thrombophlebitis. In reporting four cases of this character C. E. Connor[4] states that the position of jugular surgery in sigmoid sinus thrombophlebitis is established beyond question and the consensus of opinion is that it should be done first. The question which is still open is that of ligation versus excision. There are two schools of thought about this problem. One, exemplified notably by the men in Boston, maintains that simple ligation should be done very early, is sufficient for practically every case of thrombophlebitis, and presents great advantages over excision. The critics of this position

(4) Minnesota Med., May, 1928.

hold that ligation is done too early and upon insufficient indication, thus obtaining figures which are too high for the real value of the procedure. An equally large and authoritative school uses ligation only in very early cases, when the diagnosis is doubtful, when the blood culture is negative, or when the patient is too septic to permit prolonged procedure. These men adopt excision for most cases because they feel it is necessary to eliminate the septic vein.

One should not follow either method to the exclusion of the other. Ligation is sufficient when dealing with a case early in its course, the disease presumably not being far advanced, when the diagnosis is certain, when longer procedures are contraindicated, or when there is an apparently normal jugular vein. Excision should be used when the vein has become frankly involved below the common facial. A low ligation involves tying all the tributaries and this procedure is just as time consuming as excision and has not the additional advantage of removing the septic tissue. The author believes, therefore, that ligation should be employed only when one can place a ligature about an apparently healthy vein above the common facial; excision should be used when the vein is manifestly involved below that point.

Disturbance of Speech in Patients with Otogenous Abscesses of the Temporal Lobe. In otogenous abscesses of the temporal lobe on the left side of right-handed persons, the diagnostically important disturbances of speech occur much more frequently than is thought. R. Sonntag[5] found them 155 times in 177 patients (87.5 per cent). In the majority of positive cases reported by the author, word amnesia, with or without paraphasia, was established without determining the presence of other kinds of sensory aphasia. With the diagnosis made, immediate operation is indicated.

Pneumococcus Types in Acute Mastoiditis and "Primary" Pneumococcus Meningitis. During the past

(5) Ztschr. f. Hals-, Nasen- u. Ohrenh., Feb. 28, 1928.

four years J. T. Bauer and H. St. Clair[6] have studied the types of pneumococci that have been isolated from pulmonary and nonpulmonary pneumococcus infections occurring in patients at the Pennsylvania Hospital, and they have been impressed with the similarity of the types found in the "primary" pneumococcus infections of the mastoid cells and meninges. The authors have designated as "primary" those pneumococcus infections which did not follow directly as an immediate complication of pneumonia, although the term primary may be open to criticism in that many of the cases of pneumococcus meningitis were undoubtedly secondary to a focus elsewhere, either in the paranasal sinuses or in the middle ears. In a few of the cases the primary focus or portal of entry was obscure, and perhaps the term "cryptogenic" pneumococcus meningitis may be preferably applied to these cases.

The series consists of eighteen cases of pneumococcus mastoiditis and meningitis in which the presence of lobar or bronchopneumonia could not be ascertained either from the history or by physical examination at the time of admission. In several, however, just before death, a terminal pulmonary edema and bronchopneumonia developed, but this was thought to be subsidiary to the "primary" pneumococcus meningitis.

The results of the investigation show that in the eighteen cases of "primary" pneumococcus infection of the mastoid cells and meninges in which the organisms have been typed, type III pneumococci predominate in the cases following otitis media, and type IV pneumococci in meningitis without a history of otitis media.

Histology of Deafmutism After Scarlet Fever Meningitis. G. Ruemble[7] describes the histologic changes in two cases of deafmutism which occurred after scarlet fever. The middle ear was normal in both instances. The two patients showed the symptoms of deafmutism

(6) J. A. M. A., May 5, 1928.
(7) Ztschr. f. Hals, Nasen- u. Ohrenh., Aug. 27, 1927.

caused by meningitis. Therefore, the conclusion was permissible that scarlet fever meningitis caused the deafmutism at a time when a malignant epidemic of scarlet fever occurred. The osseous obliteration of the labyrinth corresponded with the pictures observed in deafmutism after cerebrospinal meningitis, meningitis after measles, meningotyphoid fever, etc. The first patient, a woman, aged 71, had been admitted to the clinic, Oct. 6, 1920, suffering from a diffuse bronchitis, and died on October 17. At the age of 3 years, the patient had had meningitis after scarlet fever and had lost her hearing entirely. The second patient, a man, aged 58, was admitted to the surgical clinic on May 8, 1920, on account of tuberculosis of the ileocecum. He died, October 15, with the symptoms of thrombosis of the vena cava which was verified by necropsy. At the age of 9, the patient had become totally deaf following scarlet fever.

The Genesis of Otogenic Meningitis with Remarks on the Operative Technic of Mastoid. Of 146 cases of otogenic meningitis, reported by L. Haymann[8], thirty-eight followed sinus thrombosis, twenty, abscess of the brain, and twenty-two, both abscess of the brain and sinus thrombosis. Sixty-six cases occurred through other channels. The article is well illustrated by photomicrographs. The author describes in detail a number of cases, in which the infection in well pneumaticized mastoids extended underneath the labyrinth toward the tip of the pyramid, and left a focus of pus deep in, with healing of the outer part. From this deep seated focus, infection of the meninges took place in various ways: (1) through the saccus and labyrinth, (2) to the jugular foramen, then along the nerve sheaths and (3) direct through the posterior surface of the petrosa mesial to the porus acusticus.

In order to detect these deep-lying foci the author begins operation by removing the tip of the mastoid; then its upper angle and the zygomatic petrosal cells,

(8) Ztschr. f. Hals-, Nasen- u. Ohrenh., 1927—1928.

and antrum, to the internal plate; then the deep cells between the posterior wall of the canal and sinus; last, the cells behind the sinus.

The author believes that the so-called early operation is a mistake and that better results are obtained by careful observation and operation at the proper time.

Methenamin Prophylaxis in Otolaryngology. Methenamin therapy for meningitis has been known for more than ten years. Laval[9] had given it up as a remedy in persons with well established meningitis, but in the last three and one-half years he has used it with success as a prophylactic in patients with beginning meningitis. He uses 8 tablets a day by the mouth. As the disease diminishes he reduces the dose to 6 or 4 a day. The diagnosis was made on the neurologic symptoms, as he is opposed to spinal puncture, believing that it spreads the infection which may still be localized. If the symptoms of meningitis are stormy, he uses the drug intravenously.

The symptoms of disturbance of the bladder recede promptly when the medicine is stopped. The author now treats persons with chronic suppuration with meningeal symptoms and those with circumscribed labyrinthitis with meningeal symptoms conservatively with methenamin for two weeks and then operates. There is usually a mild recrudescence of the meningitis for a few days. He also operated on three patients with chronic suppurative labyrinthitis and two patients with meningitis of mastoid and sphenoid empyema who were given methenamin intravenously; the operations were successful. Of acute forms, there were two severe and two light cases of meningitis; of the radical forms, there were six severe and ten mild cases of meningitis; there were twenty-one cases of partial and two of total destruction of the labyrinth. Of all these, one death occurred from a labyrinthogenous meningitis.

Ligation of the Internal Carotid Artery in Repeated

(9) Ztschr. f. Hals-, Nasen- u. Ohrenh., 1927—1928.

Hemorrhage of the Ear Following Radical Operations. Hemorrhages from the ear canal following a lesion in the wall of the carotid are rare. Up to 1918, forty-two cases had been reported, all with a fatal outcome. Most of the patients were tuberculous. Death results within four or five minutes, if a physician is not present to exercise strong pressure on the common carotid artery and pack the ear canal. These measures are not always successful. Therefore, ligation of the common or the internal carotid is necessary. Hessler thinks that ligation of the internal carotid artery is not sufficient.

E. Charshak[1] reports a case in point. A woman, aged 43, had developed suppuration of the ear, after typhus, five years previous to examination. On January 31, a radical mastoid operation was performed. On February 19, a sequestrum was found located farther to the front. An attempt was made to remove the sequestrum, and a severe arterial hemorrhage resulted. Tight packing stopped the hemorrhage. Another hemorrhage occurred on February 23, and a third on March 17. Under local anesthesia the internal carotid artery was tied within a few hours. The patient recovered. The internal carotid artery was not ligated after the first hemorrhage because the good effect of packing by way of the external meatus had created false hopes.

The Internal Ear

The Relation of the Sensory Hairs of Corti's Organ to the Membrana Tectoria. Hensen's view that the sensory hairs merely touch the lower surface of the tectorial membrane is generally accepted. The great majority of investigators agree with him on account of the result of many painstaking observations. H. Held[2] considers Wittmaack's view untenable when he says that

(1) Ztschr. f. Hals-, Nasen- u. Ohrenh., Dec. 22, 1927.
(2) Ibid., Aug. 27, 1927.

the sensory hairs of the inner hair cell are bent at a right angle and enter the basal layer of the tectorial membrane. The author also claims that the existence of a cementing substance between the sensory hairs and the membrane has not been proved. Furthermore, the sensory hairs and the fibers of the tectorial membrane are two entirely different formations which develop from different types of cells. The author examined some of the slides given to him by Wittmaack after he had stained them with molybdenum-hematoxylin. The author furnishes eight microphotographs to prove his assertion, and calls attention to the manner in which artefacts are created and lead to deceptive conclusions.

Suppurative Labyrinthitis. G. W. McKenzie[3] reports a case of suppurative labyrinthitis. After discussing the symptomatology he states that in the presence of a positive diagnosis of a diffuse labyrinthine destruction, secondary to a middle ear suppuration, the question naturally arises, "What are we to do in the case?" Generally speaking, it would be safer in all cases of the kind to perform a radical mastoid operation, followed up immediately with an operation on the inner ear for the purpose of draining it. The reasons are as follows:

1. That these cases present, besides the evidence of inner ear abscess, all the symptoms and signs of middle ear suppuration sufficiently severe in itself to call for a radical mastoid operation, which if allowed to go unoperated, can terminate fatally from some other intracranial complication, secondary to or even independent of the inner ear abscess. In other words, a suppurative process of the middle ear severe enough to invade the adjacent inner ear could also invade the adjacent intracranial structures (the meninges, brain substance or venous sinuses). Besides, a suppurating inner ear is always a menace by reason of the facility with

(3) Tr. Am. Laryng., Rhin. & Otol. Soc., 1927.

which the infection can spread along the preformed ways to the intracranial structures of the posterior fossa.

2. The risk to the patient's life from operating on the labyrinth is far less than from failure to operate. In fact, the risk from operating the labyrinth where the infection has not already spread to the posterior fossa is practically nil. Indeed it is no greater than in the ordinary radical mastoid operation.

3. The risk to the patient's life from operating upon the mastoid and middle ear spaces and leaving the suppurating labyrinth untouched is greatest of all. The writer witnessed two fatalities where the surgeons, both very capable men, had hoped that the loss of function in the labyrinth was but transient, due to what they supposed was merely serous labyrinthitis. They trusted the radical operation alone would suffice. Both cases died in less than forty-eight hours from fulminating purulent meningitis hastened by the incomplete operation of a suppurative labyrinthitis.

4. In the case of a diffuse labyrinthine suppuration, there is no reason why anyone should hesitate about draining the pus from the infected ear. It is a logical surgical procedure and in itself can do no damage to the anatomic structures that have not already been destroyed in the suppurative process; remembering, too, that a suppurating inner ear can never function again, even without an operation.

The author also makes the following general observations:

1. Most of the cases studied by the writer present the history of repeated attacks of vertigo lasting from a few minutes to a half hour. These attacks of vertigo are most likely due to congestion of the inner ear. If they were caused by any changes in the inner ear of a more severe nature, for instance, serous labyrinthitis, the vertiginous attacks would last longer. Furthermore, in those cases presenting such a history, where the opportunity has been offered for close study during an

attack, nystagmus was invariably found to exist, directed toward the side of the ear affected; corresponding, therefore, to what the writer has chosen, with others, to designate clinically as an irritative lesion.

These flitting attacks of vertigo from congestion are not to be confused with the severe final attack which accompanies the destructive type of lesion, as found in labyrinthine suppuration, in which the nystagmus is very pronounced and is directed away from the side of the affected ear.

2. In all cases diagnosed as labyrinthine suppuration, the patient presented the two strongest signs of diffuse destruction of the inner ear, to wit: deafness to loud conversational voice spoken through the speaking tube in the affected ear and the noise producer in the unaffected ear; complete loss of the function of the semicircular canal apparatus, as indicated by the inability to produce a change in the character or direction of the existing nystagmus with a stream of cold water played into the external canal of the affected ear over a period of eight minutes or more.

3. In practically all cases there was one outstanding symptom besides those generally accepted as characteristic of diffuse inner ear suppuration, and that was headache. The writer first observed headache as a common occurrence in labyrinthine suppuration as far back as 1907, when he was "Zimmerartz" in the Politzer Clinic and later in Alexander's Clinic. He pointed out to his chief, Alexander, the observation of headache in practically all cases of labyrinthine suppuration. From that time he has continued to observe the symptom and considers it one of importance, especially since it disappears following the operation upon the labyrinth. It may be looked upon more or less as a danger signal indicating an intracranial complication.

4. Although the writer is unable to trace the end-result in all cases that he has operated upon, he finds the number of facial paralyses following the labyrinth

operation is approximately 50 per cent, which is rather higher than it should be. The fear of its occurrence tends to deter one from operating as often as the operation is indicated. Facial paralysis occurs in spite of precautions taken against injury to the nerve just below the prominence of the external semicircular canal. It is only recently that the writer has come to the conclusion that the injury to the nerve probably occurs most often as the result of chiseling too high over the promontory and thereby damaging it in the region of the geniculate ganglion.

5. The best evidence that one has operated upon a labyrinth already destroyed by a suppurative inflammation is the finding, not only of pus upon opening the inner ear, but the absence of additional vertigo or change in existing nystagmus following the operation. For instance, given a case of doubtful labyrinthine suppuration in the course of middle ear suppuration, with a remnant of function present but not recognized, the operation of draining the labyrinth would, in consequence of the destruction of that remnant, be followed by an exaggeration of the vertigo and the nystagmus to the side opposite the lesion. Furthermore, where the inner ear is drained in the presence of a purulent inflammation, there follows prompt relief of all symptoms, including headache; where the labyrinth is more or less intact, the patient feels worse.

6. Following the operation upon the labyrinth the results generally are more satisfactory than after the ordinary radical mastoid, in that healing takes place somewhat more promptly and the cessation of the discharge is more certain. In ten of the twelve cases reported there was complete cessation of the aural discharge within a reasonable length of time. In one case the aural discharge was present one year after the operation. However, the patient had syphilis; besides, it was difficult to keep him under control, in that he was going to several other physicians at the

same time he was supposed to be under the care of the writer. In the case with complicating brain abscess, the patient's death occurred before there was any chance for the wound to heal.

Indications for Labyrinthectomy with Especial Reference to the Acute Diffuse Destructive Type of Labyrinthitis. Lund's[4] indications for labyrinthectomy are the presence of intracranial complications or the finding of pathologic changes in the labyrinth at the time of radical mastoidectomy. He considers pleocytosis as evidence of intracranial complications (meningitis), and his definition of this is three lymphocytes per cubic millimeter of spinal fluid. Neither the acute nor the chronic form is per se an indication for labyrinthectomy. Latent labyrinthitis seldom causes intracranial complications. These occur during the acute stage. Of fifty patients with latent labyrinthitis (functionless) on whom radical mastoidectomy was performed, only one died of meningitis; therefore the operation on the middle ear alone is not dangerous in this type of condition. The author believes that the danger of latent labyrinthitis is exaggerated. Circumscribed (fistula) and serous labyrinthitis are in the same class as chronic diffuse destructive labyrinthitis unless labyrinthectomy is performed. Of 159 cases in which fistula occurred, intracranial symptoms eventually developed in 37, with 12 deaths. Experience shows that as soon as a fistula becomes diffuse, the cerebrospinal fluid shows pleocytosis. In more than one half of the cases in which fistula occurred, the patients were infected with meningitis before symptoms of diffuse labyrinthitis appeared and before there was complete abolition of the function of the labyrinth. This was verified in nineteen cases, and probably occurred more often. Therefore, lumbar puncture is indicated in every case of serous and in every case of circumscribed labyrinthitis (fistula) with marked symptoms of the labyrinth with reduced function.

(4) Ztschr. f. Hals-, Nasen-u. Ohrenh., 1927—1928.

In the clinic with which the author is connected immediate lumbar puncture is performed on every patient with acute, diffuse, destructive labyrinthitis. If there are no clinical symptoms of meningeal irritation and if there are five or six cells in the Fuchs-Rosenthal counting chamber (equals 3 per c. mm.), or if clinical evidence of meningeal irritation develops, another puncture is done in twenty-four hours. If more than six cells appear, labyrinthectomy is performed immediately.

1. Not only in cases of acute diffuse destructive labyrinthitis, but in cases of marked serous or circumscribed labyrinthitis, is operation performed if the cell count increases or if the first count is fifteen or twenty cells per cubic millimeter.

2. Acute diffuse destructive labyrinthitis is indicated if the first count shows six cells in the counting chamber, namely, two per cubic millimeter.

3. If there are less than six in the first count, the second count is unnecessary unless clinical evidence of meningeal irritation develops, especially a rise in temperature. This warning comes in time for the surgeon to perform a labyrinthectomy successfully.

4. An immediately arising postoperative (including extraction of polypi) case of acute diffuse destructive labyrinthitis indicates immediate labrinthectomy without awaiting the cell count on the spinal fluid. Increase is nearly always present.

The author quotes Neel, who, on the basis of 6,004 examinations, states that the normal cell count is from 0 to 1 per cubic millimeter. When operation was delayed until there was a cell count of more than 3, it was often too late. Since 1921, when 3 cells per c. mm. was established as an indication the operative procedure has never been resorted to too late. Examination of the spinal fluid in many cases is the best guide; it is better than functional examination, as meningitis may precede total loss of function. By careful observation of

the patient, one or two punctures only are necessary if they are made at the right time.

The author is convinced that four-fifths of all cases of acute diffuse destructive labyrinthitis in which there are intracranial complications are accompanied by pleocytosis from the beginning. If puncture at the onset of the destructive process shows the fluid to be normal, the case usually remains uncomplicated.

The author compares his mortality rate in 44 cases (31 labyrinthectomies) in which the patients were admitted before meningitis occurred, or 11 per cent, with Holmgran's statistics, 29 cases who followed the indications of the Vienna school (all labyrinthectomized), or 31 per cent. The author's total mortality in 63 cases was 27 per cent.

Labyrinthine meningitis in cases of acute suppurative otitis is most malignant and is usually present before total loss of function. In these cases a change of the spinal fluid is the earliest sign of meningitis. Acute exacerbation of chronic suppuration is almost as unfavorable. In both cases, infection takes place through a window. The meningitis is perhaps less foudroyant than in acute suppuration; so in these cases the author's indications are practically the same as those of the Vienna school.

Cases of cholesteatoma have a relatively better prognosis. In 19 cases complicated with meningitis 13 patients were saved (out of a grand total of 130 cases).

Sudden cases of postoperative acute destructive labyrinthitis are nearly all complicated by meningitis, and immediate labyrinthectomy should be performed. Then the prognosis is better than in acute suppurative otitis media. Postoperative cases occurring from five to fifteen days or longer after operation without severe symptoms are not dangerous, and operation need not be performed.

In the discussion, Lange divided labyrinthitis practically into two classes: harmless and dangerous. The

harmless cases are those in which the inflammation is limited to the labyrinth. The patients in these cases tend to spontaneous recovery. The dangerous cases are those complicated, especially by the threat of or presence of meningitis. It is a mistake to classify the serous form as necessarily harmless and the suppurative as necessarily dangerous. In uncomplicated cases, labyrinthectomy is not required, but the operative observations may lead to the labyrinth. For the diagnosis of beginning meningitis the best guide is the changes in the spinal fluid; however, Lange makes some exceptions. Labyrinthitis in beginning acute suppurative otitis media is relatively harmless, even if there are slight changes in the spinal fluid. A simple antrotomy or radical operation for relief of disease of the internal ear is sufficient, and the meningitis which has just appeared recedes. In subacute or acute exacerbations in chronic cases, however, Lange advises labyrinthectomy as soon as meningeal symptoms are present. Postoperative or traumatic cases require immediate labryinthectomy on the slightest evidence of meningeal involvement. He is more conservative, however, concerning recent cases than concerning those which develop late after trauma. Hearing is the best test of function. He operates only on labyrinths in cases in which the patients are practically totally deaf. He opens the cochlea, exenterates the modiolus and opens the vestibule. The canals are spared unless definitely diseased. He cautions the surgeon always to uncover the region of the saccus endolymphaticus for fear of overlooking an important focus. Lange has not lost a patient because of failure to operate when these indications were present.

Bruenings called attention to the disagreement concerning the number of cells in the spinal fluid which characterize meningitis. He has experimented with the cell count in different portions of the spinal fluid and has found that the number differs. It is greatest at the point of production. If drained dry, the last portion

contains more cells than the first. After the Queckenstedt compression, there is still residual fluid; therefore the cell count is not a reliable sign. (His case reports in support of his theory are not convincing.)

Van Gilse says that in Holland the indications accepted are more conservative. They have less material but in twenty years only two patients with postoperative cases with stormy onset have been labyrinthectomized in the Buerger clinic. The surgeons operate only if there is complete loss of function in definite diffuse suppurative cases. They believe that their method of using burr and rongeur is safer than chiseling.

Kobrak's method of caloric reaction is not reliable in severe infections of the labyrinth.

Uffenorde called attention to the absence of a consensus of opinion concerning the treatment of patients with labyrinthitis. He does not agree that total loss of function is per se an indication for labyrinthectomy. In the induced labyrinthitis of acute otitis, operation is performed only if indicated by the mastoid or retrotympanal symptoms. Only invasion of the meninges justifies operation on the labyrinth. It may be difficult to tell the exact moment at which this occurs, and there are no certain methods of examination of the spinal fluid; yet careful clinical observation will usually give the right time for intervention, and in general, the most certain sign is changes in the spinal fluid. Uffenorde has seen cure by operation in a case of acute otitis in which within thirty-six hours from onset a streptococcus labyrinthogenous meningitis was present. The differentiation of serous and purulent labyrinthitis may be impossible. In every case of labyrinthine meningitis, Uffenorde believes that the internal auditory canal should be opened. He agrees with Hinsberg that in uncomplicated cases it is unnecessary, but operation on the labyrinth is also unnecessary in such cases. He opens the internal auditory canal only at the fundus, and thereby obviates

the objection that the Neumann procedure breaks up protective adhesions.

Neumann discussed only acute otitis. In labyrinthitis with complete loss of function occurring early (first day or so), immediate antrotomy is performed. In destructive labyrinthitis appearing later and also in mucosus otitis, he performs the combined radical and labyrinth operation in one stage. He also says that meningitis may occur before the spinal fluid shows any change. He has also observed meningitis which occurred two months after invasion of the labyrinth.

Endolymph Current in the Semicircular Canals. Investigations by W. Undritz[5] confirm the experiments of Maier and Lion, who showed that variation of temperature and rotation may cause a motion of the fluid in glass capillaries of the dimensions of the human membranous semicircular canals. The start of the movement of the fluid depends, all things being equal, also on the difference of temperature. The relation of the velocity of the current in reference to the radius and the length of the capillary was directly proportional to the square of the radius, and indirectly proportional to the length of the capillary.

The observations on the relation of the velocity of the current to the difference in temperature (D) correspond closely with the results of Maier and Lion. They also corresponded with the statement of Schmalz concerning the semicircular canals. (With D=1 C, the shifting of the endolymph is stated to be 2 microns per second.) The smallest difference in temperature (D) that could be determined with the thermo-element and caused a noticeable movement was 0.2 C. The experiments confirmed the correctness of the principle of W. Wojatschek concerning the determination of the extent of the extralabyrinthian obstacle of heat conduction by calorization at two different temperatures.

The experiments prove the possibility of endolymph

(5) Ztschr. f. Hals-, Nasen- u. Ohrenh., Oct. 28, 1928.

movement and furnish support to the physical theory, although they do not justify the exclusion of all other supplementary factors, for instance, the effect of the blood vessels. Therefore, this physical phenomenon furnishes the most natural explanation of all physiologic facts that can be explained by an endolymph movement.

Vertigo: Surgical Treatment. Georges Portmann[6] calls attention to the relation between glaucoma and increased intralabyrinthine pressure. He recommends opening the saccus endolymphaticus in cases of distressing vertigo, and gives directions for performing the operation. Portmann has conducted a series of experiments on fish and believes that the function of the saccus endolymphaticus is no longer a matter of doubt.

In man, in whom the anatomic conditions are strikingly different and in whom one can rely only on physiology and pathologic anatomy for conclusions, there is justification for believing that the saccus, by its location between the layers of the dura, is influenced constantly through pressure from the subarachnoid spaces. Modification of tension of the cerebrospinal fluid should, therefore, be able to disturb the normal function of the labyrinth.

As in glaucoma, the ophthalmologist punctures the cornea to relieve the intra-ocular hypertension which is capable of destroying forever the vision of the eye, so, in continuing the comparison, it seems logical in some cases of serous labyrinthitis, in which medical treatment has failed, to make a decompression of the internal ear to relieve intralabyrinthine pressure.

The membranous labyrinth, protected in a casing of the bony capsule of the labyrinth, from which it is separated by the perilymphatic spaces, is practically inaccessible. At one point only is it vulnerable. This is through the endolymphatic saccule, placed in the fossa which bears its name, on the posterior surface of the petrous bone. At this point a decompression can be

(6) Arch. Otolaryng., October, 1927.

made, when hypertension exists. Thus, the otologist has been presented with a new procedure of surgical therapeutics in cases in which one might suspect the existence of a serous labyrinthitis or in which an intracranial hypertension of whatever origin produces a violent reaction within the labyrinth.

[Portmann's operation seems to offer hope to some otherwise hopeless cases, but it will require a large experience and much study of indications before the operation can become a standard procedure.—Ed.]

The Elements of Vertigo. Vertigo, according to L. M. Hubby[7] is a complex made up of three elements. The vestibular nerve reaction movement reflex; the sensation of turning, and the resulting opinion of the sensation followed by psychic and somatic reactions.

1. *The Vestibular Nerve Reaction Movement Reflex.* The vestibular nerve reaction movement reflex passes from the labyrinth to the vestibular nerve centers (Deiters' nucleus, ventrocaudal nucleus of Deiters, nucleus triangularis, Bechterew's nucleus, nucleus embologlobosis, then to the dentate nucleus, the cerebellar cortex, back to the dentate nucleus, then to the red nucleus and last, by the rubrospinal tract to the motor cells in the anterior horn of the cord and to the muscles. This reflex contains at least seven neurons. Involvement of any one of them may produce vertigo.

Other neurons also enter into the reaction reflex: the corticospinal from the motor cerebral cortex to the motor cells in the anterior horns of the cord and thence to the muscles; the deitersospinal from the vestibular nuclei to the anterior horn cells and muscles; the corticopontile tract to the cerebellar cortex; the tracts from the vestibular nuclei to the cortex of the worm; then to the nuclei tecti (fastigii) and back to the vestibular nuclei and undoubtedly many others not yet traced.

2. *The Sensation of Turning.* The sensation of turning is brought about by the passage of these vesti-

(7) Arch. Otolaryng., November, 1927.

bular impulses of changed relative intensity from the two sides, to the centers situated in the parietal cortex, subcortex, or the optic thalamus. Physiologists are still in doubt as to the exact locality.

There may be a slight feeling of turning in the cerebellum and the brain stem, but it is, in the main, probably subconscious and does not become well defined until reaching the higher centers. On the other hand, the sensation may be a resultant from all these sources. At any rate it is beyond the arcs of vestibular somatic muscular reaction.

The muscular reaction movements of the eyes, limbs and body are also followed by sensory impulses to the sensorium, which contribute to form the vertigo complex.

It would seem probable that the nearer the labyrinth the alteration of the afferent impulses from the labyrinth occurred, the clearer the sensation would approach that of real turning and the greater the vertigo.

3. *The Resultant Opinion of the Sensation Followed by Psychic and Somatic Reactions.* Every projection center is connected with every other one by associatory neurons and is also thus connected with the associatory areas, in which the different concepts are supposed to arise, together with the motivating feeling to act.

The sensation of turning, clearly felt in the parietal cortex, is further analyzed in the association areas; it is compared in quality and intensity with past experiences together with their sequelae, and a real concept is developed. This results in anxiety or fear and produces all the concomitant somatic reactions depending on the temperament and physical constitution of the subject.

This may bring about changes in the circulation of the blood, feelings of flushing of the face, faintness, syncope, etc.; respiratory changes; gastro-intestinal reactions such as nausea, vomiting and diarrhea; changes in the kidneys, such as increased micturition and production of urine.

Otitic vertigos and those caused by diseases of the vestibular nerve tracts up to the parietal cerebral cortex involve all three of the foregoing components of the complex called vertigo; hence the result, marked sensation of turning, etc.

When the two other components outside of the ear and the vestibular tracts only are affected, such as the multitude of associatory fibres, not only in the cerebral cortex but also in the rest of the brain, then the sensation of vertigo is much more confused and may amount merely to a feeling of uncertainty. This is true of ocular and psychic vertigoes.

Of course, vertigo may be of a turning type, when the nerve currents are sufficiently strong to spill over from neighboring neurons, such as the oculomotor to the vestibular neurons, but the author believes that is rare.

Conclusions: 1. The basic part of true vertigo occurs in the series of vestibular neurons connected with the production of reaction movements of the muscles.

2. The afferent impulses initiating these movements start in the labyrinth, mainly from the semicircular canals.

3. These afferent impulses are caused by the continuous series of intracranial pressure waves transmitted directly to the vestibular nerve endings in the labyrinth through the ductus endolymphaticus.

4. Sufficient alteration of the impulses from one side produces a tendency to reaction movements of the muscles and vertigo. This alteration may occur in the generation of impulses in one labyrinth as compared to that in the other or in a change in the transmission of the impulses through the vestibular chain of neurons of one side to the brain centers.

The Physiology of Equilibration. In this article J. M. O'Connor[8] discusses mainly the researches of Magnus. In the course of the development of his experiments Magnus had occasion to do the well-known Sher-

(8) Irish J. Med., January, 1928.

rington operation of decerebration. In this a cut is made across the brain stem at the level of the cerebellum. The animal passes almost immediately into a condition of rigidity of all the extensor muscles, i.e., all the muscles which normally oppose the action of gravity in limbs, neck, trunk and tail. Magnus, in changing the position of such an animal, noticed that the tone of the limbs altered. This phenomenon had been noticed before, but Magnus set out systematically to seek the cause.

Early observations showed such a confused picture that he, too, might have well been deterred from tracing the underlying rules. It was well known that movement of the head causes reactions. Here, however, it was not a question of movement, but of position. When the animal was moved, brusquely or gently, into a new position the extensor muscles relaxed or contracted so as to give the animal a new pose, which pose it maintained so long as there was no further positional change. At first sight, there appeared irregularities and confusions. For example, when the head of a standing decerebrate cat was bent downwards towards the fore feet the hind limbs sometimes extended and sometimes relaxed. Again, if one put the animal on its side and twisted the head round so that the chin turned upwards one found that both forelimbs extended in some animals, whereas in others the under limbs relaxed. Magnus found the clue in the existence of two sets of reflexes, one a response to changes of position of the head to space, the other to changes of the relation of the head to the trunk. If either be taken separately the results are consistent.

It is known that in the membranous labyrinth there are in addition to the cochlea and the semi-circular canals two sacs called the utricle and the saccule. To each of these there is attached a branch of the eighth nerve. This nerve ends in what is called the macula; to each of these maculae there is attached a calcareous

deposit which we may call the otolith. As may be seen from a model, when the head is in the normal position the surfaces of the maculae of the utricles fall upwards and backwards, and those of the saccules outwards and slightly backwards and upwards. Magnus concentrated on determining what feature of the labyrinth showed a maximum when the head was in such a position that the decerebrate rigidity would be maximal, i. e., when the mouth was at an angle of 45° to the horizontal. The one definite result which he could obtain was that tonus was maximal when the otolith was hanging from the macula of the utricle.

Magnus finds that both labyrinths influence the tone of the limbs on both sides, but this is not the case with the extensors of the neck and trunk. These also show decerebrate rigidity, but this rigidity is influenced only by the labyrinth of its own side.

If the section of the brain stem be made at a higher level, *e. g.*, above the thalamus, the rigidity so characteristic of those in which a lower section has been made is completely absent. In these animals one can demonstrate the alterations of tone with changing position. They show further an additional series of reflexes known as the *Stellreflexe*, or "righting" reflexes. The decerebrate animal, though influenced by every position into which it is brought, shows no signs of endeavoring to regain any particular position. An animal with a section made at this slightly higher region always endeavors to regain a position similar to the normal.

That the righting reflexes on the head are due to some stimulus in the head itself is shown by examining a thalamus animal or a normal animal held in mid-air. No matter how the trunk be grasped or held or twisted the head always swings into its normal position. This reflex adjustment of the head is completely absent when the labyrinths have been removed.

The assumption of the normal position of the head in space is also influenced by a righting reflex from the

body to the head. If an animal without labyrinths be held in mid-air, the head falls in whatever direction gravity pulls it. The moment the body touches the ground the head swings into position. If one side of the body be pressed upon from above by a board, as the other touches the table, so that there is no asymmetrical stimulus, the head does not take the natural position.

The body is brought into a normal position largely by a reflex through the neck. If the neck be twisted, a reflex occurs undoing the twist and bringing the body into line. This can be shown particularly in thalamus animals in the early stages of recovery from shock or anesthesia. In these a twisting of the head out of the normal position into a lateral position causes the body to swing round also into a lateral position. The body is, however, not dependent on the head alone for guidance, even in the thalamus animal. Even if the head be held in an abnormal position a pinching of the skin of the trunk will cause the animal's trunk to swing into the normal position again. This is naturally described as a body reflex on the body.

An animal with one labyrinth removed shows a twisting of the neck. This twisting of the neck is due to the fact that the utricle of each side controls the neck and trunk muscles of that side only. The animal being held in mid-air, the head in practically all positions of the body is brought by some movement of the neck to lie so that the uninjured labyrinth comes on top. If one examines the anatomical relations in detail one finds that the position into which the head is brought is one in which the otolith of the solitary remaining saccule is resting on its macula. In all other positions the muscles of the neck are stimulated so as to bring the head into this position. The stimulus for the righting reflexes then seems to be the hanging of the otolith from its membranes.

All the evidence presented with regard to the head reflexes goes to show that they come from the utricle and

saccule. The utricle is responsible for variation in distribution of tone in the muscles, and also possibly for righting reflexes in the head from divergences in a sagittal plane. The saccule is responsible for the control of the superior and inferior recti of the eye and also for the righting reflexes from a displacement in the normal vertical plane.

It has been believed that these reflexes result from the action of gravity on the otoliths. Magnus' laboratory has furnished evidence along this line. Guinea-pigs under ether narcosis were centrifuged in a large machine for a very brief period. The labyrinthine reflexes were tested before and after the procedure, and in many the positional reflexes were found to have disappeared. These animals were killed, and their labyrinths cut in serial sections. It was found in all that the centrifugal force had shaken off the otoliths from the maculae to which they are normally attached and through which they exercise their activity. It has been known for a long time that movements of the head and eyes occur during rotation; and on stoppage of rotation these reactions to movement (not to position) have long been attributed to the semicircular canals; Magnus confirms this by finding that they still persist when the otoliths had been removed by centrifugal force as distinct from angular movements. The chief of these he called "jump-readiness" or "fall-readiness;" this consists in a stretching of the forelimbs when the body is moved suddenly downwards. This, though absent in animals without labyrinth, persists in those animals in which the otoliths had been shaken off. They must, then, unless there is some flaw in the argument, be due to the semicircular canals. It is difficult to see how a flow in the fluid of the canals could occur as the result of such motion, but Magnus with expert physical aid concludes that the existence of the ductus endolymphaticus makes such a motion possible.

The removal of both labyrinths produces singularly

little effect apart from early violent symptoms on which we need not dwell. Cats have a peculiar tendency to move backwards, which though it tends to disappear, shows itself when the animal is placed in a difficulty. For a long time after apparently complete recovery they look continuously to right and left as they walk. Obviously, they rely largely on the eyes for purposes of equilibration. The recovery is finally very complete, and a cat without labyrinths may even learn to walk on its hind legs. The one thing they cannot master is the ability to turn in the air when falling, and to take the weight of a jump on the outstretched forelimbs. This well-known ability of the normal cat to fall on its feet depends on labyrinthine reflexes, and has been analysed by Magnus with the aid of the cinematograph.

In none of these animals deprived of their labyrinths was there any sign of a general loss of tone, as had been hitherto considered to be the chief result.

In studying the foregoing experimental work the author notes the small part played by the cerebellum in the reactions observed. The removal of the cerebellum does not affect any of the reflexes considered, except for the body reflex on the body. It is also to be noted that the Utrecht workers have not been able to attribute the decerebrate rigidity to any definite collection of nerve cells. More success has, however, attended the search for the centre for the maintenance of normal body tone. The hindmost section permitting this to be maintained lies just in front of the red nucleus. Various sections of the brain-stem showed that the portions of the brain-stem lying dorsal to the aqueduct were of no significance. Further enquiry permitted the exact localisation of the centre in the red nucleus.

Preliminary Report on Sodium Nitrite Therapy in Seasickness. During a study of the effects of blood pressure on the labyrinthine function, J. F. Pearcy and D. B. Hayden[9] were impressed by the depressant effect

(9) J. A. M. A., April 14, 1928.

of sodium nitrite on the vestibular responses. The results of these studies are in process of preparation for publication. In these studies it was shown that by lowering normal blood pressure to between 95 and 105 mm. of mercury the nystagmus after rotation was greatly diminished, and past pointing was also much diminished and even disappeared entirely in some instances.

Believing that seasickness is due mostly, if not completely, to overstimulation of the vestibule, the authors felt that the nitrites offered a direct attack at the long sought but never attained cure for the terrible malady of the ocean voyage. Consequently, as one of the writers (D. B. H.) was about to cross the Atlantic, it was decided to put the theory to the test. On the return trip there were sixteen suffering from seasickness. They were all given one of the usual treatments, namely, subcutaneous injections of epinephrin hydrochlorid. For the authors' test the patients were divided into two groups, eight to serve as controls and eight to have nitrite treatment. The groups were chosen with the effort to have them as equal in symptomatology as possible. The members of the control group were prostrated on the average two days, and there was not much variation from that period. The members of the other group were given from 3 to 5 grains (0.2 to 0.3 gm.) of sodium nitrite every two hours until they experienced relief. The average period of time before the members of this group were free from ocular nystagmus, vertigo, ataxia and nausea, and were comfortable on deck and able to eat meals was four hours! These persons did not suffer from any recurrence of symptoms.

Although this work has a sound experimental basis, the actual tests having been adequately controlled and 100 per cent of cures obtained, the authors expect to use nitrites in a much greater series before drawing final conclusions. They are certain that they will cure many cases of seasickness but it is possible that there are cases that will not be cured.

The Treatment of Otolith Vertigo. Owing to the occurrence of vertigo after the use of tobacco which is a paralyzer of nerves of the sympathetic system Vogel[1] tried a stimulant mainly epinephrin hydrochlorid, with excellent result in most cases. A dose of from 0.3 to 0.5 c. c. of 1:1,000 solution was used hypodermically. The good results lasted from three to eight days, but the doses had to be repeated. Several of the patients had been treated by other well known methods without success. He also experimented with ephedrin with good results, using 0.025 to 0.05 from one to three times a day. One experiment with a synthetic substitute was successful. The result was not immediate: it sometimes took twenty-four hours.

Ménière's Disease. As a result of his experience, W. E. Dandy[2] believes that intracranial section of the affected eighth nerve may be performed as a cure for Ménière's disease. This operation has been performed on nine patients, none of whom has had a subsequent attack. The elapsed time since operation varies from three months to three and one-half years.

The operation should be attended by no mortality and with no after-effects, since the patients are practically deaf in the affected ear before operation. Although the series of cases is small, the results suggest that section of the acoustic nerve should stop Ménière's attacks just as absolutely as intracranial section of the glossopharyngeal nerve or of the sensory root of the trigeminus stops the attacks of tic douloureux in these two nerves.

It would seem that the treatment in cases of true Ménière's disease by section of the eighth nerve has precisely the same rationale as section of the sensory root of the trigeminal or glossopharyngeal nerves in tic douloureux. If the attacks begin either in the eighth nerve or in the cochlea—and they begin in one or the other—and if the lesion is strictly unilateral, impulses

(1) Ztschr. f. Hals-, Nasen-u. Ohrenh., 1927—1928.
(2) Arch. Surg., June, 1928.

can no longer be transmitted after section of the nerve. It is then hardly conceivable that future attacks are possible after section of the eighth nerve. Moreover, since section of the nerve is central to the ganglionic cells in the semicircular canals and cochlea, regrowth of the nerve and recurrence of the attacks should be precluded. If these impressions and deductions are correct, section of the eighth nerve should serve as a therapeutic test of Ménière's disease just as section of the trigeminal sensory root or of the glossopharyngeal nerve are tests for tic douloureux of these nerves.

There appear to be reasons to doubt that the cause of Ménière's disease is primary in the semicircular canals. A primary lesion of the acoustic nerve seems a more probable primary source of the attacks.

The More Delicate Construction of the Bone of the Normal Human Labyrinth Capsule. Meyer[3] shows by the use of fibrillar stains and polarized light that the enchondral labyrinth capsule is not lamellated, but fine fibered and marrow-boned.

Miscellaneous Conditions

The Conservation of the Hearing Function as a Health and Social Science Problem. W. C. Phillips[4] commends very highly the examination of the public school children. By this method research work along the lines of prevention of deafness may be carried out. He feels that educators, legislators and philanthropists should be interested in the support of this problem. The various social organizations for the "Hard of Hearing" have been doing and are doing exceedingly effective work in the education and management of the deafened.

The otologists have had much to learn from the accomplishments of these social organizations for the

(3) Ztschr. f. Hals-, Nasen- u. Ohrenh., 1927—1928.
(4) J. Med., October, 1927.

deafened. There is no more trying experience than to be called upon by a deafened patient to give a final opinion, when no hope of permanent improvement may be held out. Older otologists frequently are obliged to face this ordeal. In the functioning of this experience the prevention of deafness plays no part, for in every instance the days of prevention have passed. Likewise in the majority of cases no well-founded hope for improvement can conscientiously be vouchsafed. The otologist must face the bald facts surrounding his deafened condition, not only in the patient's interest, but it must be in a manner that will preserve his own integrity and honesty of purpose. At this very point arises the otologist's opportunity to become his patient's neighbor in the highest sense, and it is here that he may profitably enter the field of sociology, at least so far as sociology as a science may pertain to the welfare of his deafened patient. It is one thing for the otologist, after having conducted all the hearing tests, to conscientiously tell a deafened person, even in the kindest way, that his deafness must remain permanent. It is quite another attainment to go to the necessary length of demonstrating to him how to overcome his handicap. The first is an ordinary professional business transaction, the second requires time, self-sacrifice and toil beyond the realm of financial remuneration.

The author cites examples of physicians who not only have made a scientific diagnosis, but have referred the patient to a League for Hard of Hearing and have helped him reconstruct his attitude toward life.

Sound Deadened Rooms in the Treatment of Aural Inflammations. G. B. McAuliffe[5] discusses this topic as follows:

"When we give consideration to the damage of the internal ear from the influence of constant noise as seen in certain occupations where noise is concomitant, we realise that the ear has not received the protection that

(5) Lancet, June 2, 1928.

has been given to other organs by functional rest, especially during inflammation. The stomach is rested by a careful diet. The heart is helped by interdiction of the strain of exercise. The eye is kept shaded or in a dark room or its active function is minimised by atropin. An injured joint is mobilised. I might cite many examples where functional rest is considered a sine qua non of treatment in inflammation. No one has ever considered that the ear should receive the same care. Middle-ear inflammations are allowed to pass through their course without any thought that they are prejudiced by the environmental clamor. The sequels of chronicity and mastoid involvement are almost accepted as ineluctable; we consider that we have done our best for conservation when we have opened the drum and used isotonic or antiseptic irrigations with appropriate therapy to the nasopharynx and the nose. A striking fact in the effect of noise on the internal ear is that only the tones that reach the internal ear through the oval window cause this degenerative change. Does it not seem reasonable that the functional activity of the middle ear may aggravate congestion and increase the potentiality of the aural sequelæ? We see so often aural inflammations which are beginning to show operative necessity resolve completely when hospitalised; how much more benefit would accrue to this partial rest by a more or less complete functional rest? The influence of silence on the course of laryngeal affections has been demonstrated and appreciated.

"The ear stands alone of all the organs in that it gets no real rest during the 24 hours. The ossicles and drum membrane are receiving all sounds and transmitting them even in sleep. That we do not perceive all the sounds is due to the sleep of the higher centres resulting in a lack of attention. How much influence may over-function have in starting up the peculiar degeneration of the ear in otosclerosis? Why does the spongifying osteitis start around the place of greatest functional

activity—the oval window? We may give due credit to the influence of endocrine dysfunction, to hereditary dyscrasy, to changes in calcium content or to other theories of this insidious, progressive, and incurable deafness, but we cannot explain why it begins at the foot plate of the stapes, the place of greatest functional activity of the ear. Senile deafness, appearing more early in life and before senescence of other special organs, is due to the over-stimulation of our modern environment. The clamant need, apparently, is rest. Physicists are experimenting in sound-proof rooms for the use of testing apparatuses to determine acoustic acuity.

"No attempt has been made to gauge the benefit of functional rest in middle-ear inflammations; this has never been considered as a part of the treatment and has not been deemed necessary. Is it not possible that the continuous onslaught of sound would by conduction vibrations keep up or aggravate congestion? No differential trial has been made to determine the reaction of the inflamed ear under the ordinary environment and the reaction under functional rest. The majority of patients with middle-ear inflammations are ambulatory partly from custom, partly because it is easier for the patient to come to the doctor than it is for the doctor to carry around his apparatuses. Naturally the patient feels that his condition is not one that requires either local or somatic rest. There is a great deal of difference in the treatment of the ear and the meticulous care of the eye. Why?

"It may be impracticable to suggest sound-proof rooms for aural inflammations, and of course it would necessitate a great change in hospitals to have sound-proof rooms. If that radical measure may not have a utilitarian appeal, at least the endeavor to lessen sound for the treatment of aural cases would be of decided benefit. I believe also that the onset of senile deafness would be slowed by occasional rest from noise—a rest

that may be partially gained by wearing occlusive plugs occasionally. I make the suggestion, therefore, that sound-deadened rooms should be used for aural inflammations and that the majority of acute ear infections should not be allowed to be ambulatory, but should at least be semi-hospitalised in a quiet room. I venture to assert if hospitals would furnish sound-deadened rooms for the treatment of aural cases we might see fewer sequelæ which at present are a reproach to aural surgery and there would be instituted a distinct advance in preventive medicine."

Soundproof Rooms. This investigation by D. W. Drury[6] has shown that a thick homogeneous structure has the advantages of greater inertia and rigidity, compared with a thin partition. An air space impedes transmission of sound. The deeper in the ground the soundproof room can be built, the more easily can it be made soundproof. Absorption of sound by materials is due to the porosity, compressibility and elasticity of the substances used.

The human factor of concentration varies with one's physical condition, so that it is necessary for satisfactory results to take reverberation measurements only when the observer and the observed are not fatigued. Dissimilarity of ears causes more variation than the errors of the observer's judgment. The ordinary noises of the day affect an aural acuity curve very directly. The observation that pitch more than intensity produces loss of acuity in the normal ear warrants, we think, the conclusion that the ear does distinguish the quality of a note similarly as the eye recognizes color of an object.

The Telephone and the Ear. From his investigation into the subject, J. A. White[7] draws the following conclusions:

1. That damage to the ear could possibly result from using the telephone during an electric storm, or from

(6) Laryngoscope, July, 1928.
(7) Ibid.

electric shock by a short circuit from a high tension wire, but judging by reports of such cases in the past, the damage would only be temporary. Moreover, the modern safeguards of fuses on each telephone circuit, that would be blown by a very light charge of electricity (about 350 mills.), makes such a possibility practically impossible.

2. That deafness, nausea, tinnitus and vertigo have occasionally been caused by the so-called "acoustic shock" or loud noises sometimes occurring in the use of the telephone, but such effects quickly disappear.

3. That the individuals reporting such effects were usually found to be neurasthenics.

4. The author has not been able to find a single report of damage to the static labyrinth with typical nystagmus, ataxia and vertigo, indicating involvement of the semicircular canals.

5. That the probability of harm to the ear from constant use of the telephone among employees of the telephone company is only to be considered with those employees who already had some otological trouble or were of a special neurotic tendency.

6. That, therefore, only people free from ear trouble of any kind and in a normal physical condition should be employed by the telephone company.

Otologic Observations in Trauma of the Head. Forty-two cases of fracture of the skull have been studied from an otologic standpoint by W. W. Grove[8]. He also reviews many cases reported by other observers. His conclusions are:

1. Patients with injuries of the head must be examined as soon after the injury as possible, and again at regular intervals over a considerable period.

2. The severity of the injury does not bear any direct relation to the development or degree of cochlear and vestibular symptoms.

3. Most of the injuries to the head in civil life are

(8) Arch. Otolaryng., September, 1928.

caused by a broadly acting force which compresses the skull, whether it fractures it or not. This compressing force results in damage to the brain, to the cerebrospinal fluid and to the vascular system of the blood, as well as to the skull.

4. With regard to the skull, the compressing force of the injury finds its greatest expression at the base, because of the more or less unequal strength of its constituent parts; and the middle fossa, being weaker than the anterior or posterior fossae, is most often affected. The pyramid, weakly attached in the middle fossa, takes the brunt of the injury to the base and is frequently damaged.

5. Fractures of the temporal bone are divided into transverse fracture, longitudinal fracture and avulsion of the tip of the petrous temporal bone. Of these, the longitudinal fractures are most numerous, do not damage the labyrinth by fracture, but by the concomitant concussion, and usually involve the middle ear and external conal directly by fracture. The transverse fractures are more rare, cross the pyramid at right angles and completely destroy both the vestibule and the cochlea. Avulsion of the tip of the petrous bone is relatively rare.

6. The damage to the brain is caused by actual compression of the brain beneath the point of impact and at a point directly contrecoup. The damage done by the cerebrospinal fluid is caused by the compression of the lateral ventricles which sets the fluid in motion to expend its force in a whirlpool action in the fourth ventricle. The damage to the blood vascular system consists in a state of traumatic paralysis of the vasoconstrictors with resulting stasis and prestatic circulation in the brain tissue, particularly in the central vestibular area, and probably also in the labyrinth.

7. Within the temporal bone the salient features of all patients who died and who came to autopsy were hemorrhages. The intralabyrinthine hemorrhages are al-

ways perilymphatic, unless the capsule of the labyrinth is fractured, in which case they can also be endolymphatic. The most frequently affected region in these intralabyrinthine hemorrhages is the scala tympani in the vicinity of the round window. The nerves can be either torn or damaged by pressure from hemorrhage, before their entrance into the pyramid, within the porus acusticus internus or in the narrow bone canals leading to the end-organ.

8. The pathologic changes in patients dying years after injury to the head are atrophy of nerve fibers, atrophy of Corti's organ, more marked in the basal coil, and complete or partial filling of the inner ear spaces and canals with hyaline connective tissue and bone.

9. The results of experimentation on animals show that the effects of mild injuries are the same, in lesser degree, as those found at autopsy in the temporal bone of human beings, namely, hemorrhages in the inner ear, more marked in the basal coil of the cochlea and in the region of the round window, always in the perilymph spaces and never in the endolymph spaces. Degenerative changes are seen also in the nuclear territory of the eighth nerve in the floor of the fourth ventricle, affecting mainly the small cells of the nervus triangularis, the nucleus of von Beehterew, the tuberculum acusticum and the posterior corpora quadrigemina. These changes are probably due mostly to vasomotor disturbances in this section producing a condition of stasis with subsequent destruction of tissue.

10. Hemorrhage from one or both ears occurred in nine cases in the series, and the author holds that this constitutes almost indisputable evidence of a longitudinal fracture of the temporal bone. This bleeding from the ear, however, does not mean that great damage to its function will necessarily ensue.

11. Vertigo is one of the cardinal symptoms of injury of the vestibular system. It is vestibular in origin if it has a rotary quality, if it comes on in attacks, ac-

companied by nystagmus or if it is produced by bending movements of the head. Other types of vertigo after injuries to the head are apt to be neurotic, especially if they are constantly present after the first two weeks, or if they are accompanied by severe nausea, vomiting and great mental excitement. The author is always strongly suspicious of a neurosis, if the patient, after the first week or two, complains of constant headache and vertigo.

12. Spontaneous nystagmus is another cardinal symptom of vestibular injury. It is unilateral or bilateral, and if bilateral, it is more marked to one side. It is always rotary-horizontal in character. The author believes that it is due to a decompensation between the two vestibular normal systems. Bilateral nystagmus to the two sides is often encountered in normal people, but it is always of the pure horizontal type, always equal in intensity, not associated with vertigo and never influenced by the head movements test. He cannot formulate any rule for the direction of the vestibular nystagmus in my cases.

13. Disturbances in the pointing reaction were present in 28 of 42 cases and they constitute a part of the spontaneous vestibular symptoms which occur after damage to the vestibular system. No great reliance can be placed on them in deciding which side is involved. The same hold true for the falling and Romberg reactions.

14. The irritability of the labyrinth to caloric stimulation was carefully studied in 30 cases, all of which presented spontaneous labyrinthine symptoms. Normal reactions were obtained in 10 cases, hypoirritability in 11 cases and hyperirritability in 9 cases. The comparative irritability of the two sides was equal in 12 cases and unequal in 18 cases. I believe that a difference in the irritability of the two sides, in other words, a decompensation between the two labyrinths, is of far more importance in the production of the spontaneous

labyrinthine symptoms than is hyperirritability or hypoirritability per se.

15. The Rinne reaction was positive in 35 cases, negative in 1 case and not recorded in 6 cases. Bone conduction was shortened in 24 cases, normal in 6 and not recorded in 12. Traumatic deafness, caused by injury of the head was found in 31 of 42 cases. Complete deafness in one ear was present in one case. In a large proportion of the cases the defect in the hearing was bilateral, and a large number of cases showed the upper tone range more affected than the lower and middle ranges. Of the 31 patients with defective hearing, 28 had symptoms referable to the vestibular apparatus.

Certain Aspects of Tinnitus, Particularly Treatment. As regards treatment of this condition I. H. Jones and V. O. Knudsen[9] make the following classification: Local treatment of the patient; general treatment of the patient; use of mechanical devices. Local treatment is limited to conditions of the external and middle ear; removal of obstructions in the external ear; varied measures to improve the conditions of the middle ear, such as the standard surgical procedures in the nose and throat, and local treatment to the Eustachian tube and middle ear. Such measures are not altogether unsuccessful. The authors had a case of a woman who had persistent tinnitus in both ears for two years; tonsillectomy; complete relief, now lasting three years. This woman also had a hearing defect, which was not improved, although it was thought that it was arrested, as up to that time she had been getting more and more hard of hearing. Precise measurement shows the same picture today as that of three years ago. Another woman had tinnitus, which she stated was "unbearable"; tonsillectomy was followed by relief of tinnitus in a very short time; also improvement of hearing in the right ear from an average of 30 per cent to an average of 50 per cent. The authors' "successes", however, have been pitifully

(9) Laryngoscope, September, 1928.

few. Most otologists have found that the best prospect of local treatment is in cases of tubal congestion. Lake has noted relief of tinnitus by cautious intertubal injections of glycerin-acid-carbol. Ruskin reports cessation of tinnitus in two cases, following cocainization of the sphenopalatine ganglion.

Several of the best otologists have severed the eighth nerve or destroyed the cochlea, in cases in which the tinnitus has been distracting. Nearly all now have concluded that such operations are not without danger, and that the results are almost always unsatisfactory.

We have all utilized many methods of local treatment —it is possible that many of us have been less alert than we should be in the use of constitutional treatment, directed toward the general condition of the patient. Focal infection, or constitutional disorder, may produce disturbances in the middle ear, but much more frequently affect the internal ear. General treatment, therefore, is usually directed toward the cochlea. Experience has caused many to consider that cochlear defects are frequently the results of a focus of infection, the tonsils, teeth, nasal sinuses, or in even more remote locations, such as the gall bladder or prostate. Any marked cochlear defect, with or without tinnitus, should make us search diligently for a focal infection, particularly if we cannot find any other cause of a previous toxemia, such as mumps, scarlatina, influenza or meningitis. Toxemias from such diseases have already produced the damage in the cochlea, or eighth nerve, and naturally, there is no treatment. It is a different matter if a cochlear defect, with or without tinnitus, leads one to discover syphilis. Treatment is instituted, although unfortunately such treatment usually does not relieve the cochlear defect or the tinnitus. One finds cases in which drugs, particularly quinin, have produced a cochlear defect and tinnitus, and in these cases it is also usually true that the damage has been done and no definite treatment is possible. Alcohol and tobacco at

times appear to increase a tinnitus, in which the patient is naturally advised to avoid them. Certain drugs have been empirically recommended, particularly by English otologists, which have relieved tinnitus—notably dilute hydrobromic acid in doses of one fluid dram three times a day, in water; this may be combined with small doses of potassium iodid.

In cases of hyperthyroidism, suitable treatment (such as Lugol's solution and rest), at times relieves the tinnitus which occasionally accompanies this condition. Certain otologists report good results from the use of thyroid extract, in cases of hypothyroidism exhibiting tinnitus as a symptom. Similarly, tinnitus observed during the menopause may be relieved by ovarian extract.

Many clinicians have regarded blood pressure as an important factor in tinnitus. It is certainly advisable to investigate the blood pressure in all cases of tinnitus. If the systolic pressure is low, such drugs as digitalis or strychnin may give relief, by elevating the systolic pressure. In cases of high blood pressure, the English otologists particularly have recommended trinitrin. Naturally, such conditions are best cared for by the internist. In cases in which the blood pressure appears to be a factor, the tinnitus is usually in both ears. Reik reports a case of complete relief from severe tinnitus, unilateral, by ligation of the common carotid artery; in another case, a small aluminum band was placed so as to constrict the common carotid artery, with resulting relief of the tinnitus.

Mechanical devices. The authors have constructed two types of instrument: One, for what might be termed the "bombardment" of the cochlea, and the other type for the purpose of masking the tinnitus.

The "bombardment" was suggested by the animal experiments of Siebenmann, Wittmaack and Yoshii. The object is to desensitize the cochlea in certain tonal regions —the regions corresponding to the tinnitus. The pitch

and loudness of the tinnitus are first determined by precise measurements. An objective sound is then produced, of the same pitch as the tinnitus but much greater loudness. In this way, by bombarding the cochlea with excessively loud tones, the authors have at times noted lessening of the tinnitus. Unfortunately, this fatigue phenomenon, which it undoubtedly is, does not last.

The other type of instrument is for the temporary masking of tones or noises. Two different instruments of this type may be used. The first instrument is a monotone generator. Such a generator can be readily constructed of an appropriate vacuum tube oscillator and a loud speaker. The oscillator is adjusted to produce a frequency slightly below the frequency of a tonal tinnitus.

The other instrument might be termed a harmonic generator. The instrument is adapted for masking tinnitus which is characterized either by a tone or a noise. In order to do this, the instrument must produce a complex "spectrum" of tones, with a preponderance of low pitched tones. These requirements were obtained by a very simple device. An ordinary 50 or 60 cycle alternating current is conducted through a special loud speaker and a telephone condensor connected in series. The loud speaker is a Magnavox type with an adjustable diaphragm. The adjustable diaphragm provides a convenient means for controlling the loudness of the sound. The telephone condensor of one-tenth microfarad capacity, offers a high impedance to the fundamental 50 or 60 cycles, but offers progressively less impedance to the harmonic overtones which accompany it. In this way, the higher harmonics are relatively emphasized. As a result, the current actuating the loud speaker is rich in the higher harmonics and consequently the loud speaker produces an entire harmonic series or "spectrum" of tones. The higher harmonics are further emphasized by overloading the loud speaker. This

produces additional distortion, or an increased prominence of the higher harmonics. In this way, there is obtained a broad series of frequencies, extending throughout the important portion of the speech and music range. This provides a type of sound which is capable of masking almost any tone or noise which may characterize a tinnitus. Incidentally, this "blanket noise" gives a patient with conductive impairment a relative hearing advantage over the person with normal hearing.

Although, of course, such an instrument does not "cure" the tinnitus, yet one may find after suitable experience that relief may be provided for those for example who are unable to sleep because of their tinnitus. A patient is not distressed by a sound which is produced outside of himself.

New Histopathological Findings in the Ear in Lues and Their Importance in the General Pathology of the Ear. G. Alexander[1] notes that in the early studies of the histopathology of the ear, it was believed that the many characteristic findings for the various congenital and acquired ear diseases were known. With the increase of knowledge, however, we became less certain as to the histopathological findings specific for congenital or acquired ear diseases; findings that were believed to be characteristic for congenital ear diseases (false formations and encapsulations in the inner ear, membranous duplications, etc.) were found also in cases of acquired diseases. It was found possible also to produce these changes experimentally by causing inflammation of the inner ear. Defects of the scala septa considered at first to be characteristic for congenital deafness were later found also in certain cases of internal ear conditions not associated with deafness (Mayer, Neumann, Brunner, Nager), and in cases of internal ear diseases combined with otosclerosis (Brunner). It was also found that some changes seen in otosclerosis may exist

(1) Laryngscope, May, 1928.

in cases of congenital deafness as well. These findings have led the author to believe that basal changes in cases of otosclerosis may be really congenital.

A number of changes which were believed to be pathological were found to be artificially produced in preparing a specimen. On the other hand, certain changes which were believed to be artificial were demonstrated to be actual changes. For instance, Nager and others believed that the corpora amylacea found in the eighth nerve were artificial products; whereas Obersteiner and the writer showed that this is not so.

The author reports on the histological changes of the ear in six cases of acquired lues. All of the patients were examined during their lifetime. The results of the findings, after comparing the histological findings in these cases of lues with the histological findings in the other diseases are of great interest.

It can be seen that the changes found in lues are similar in many ways to the changes in the inner ear caused by other diseases. The content of fat tissue in the inner ear observed in cretinism is found also in lues. It may be that this fat tissue really represents the low resistance of the organ which in German is called "minderwertigkeit". This may explain how in some cases of lues the ear is affected and not in others.

The finding of different degrees of atrophy in Corti's organ and in the nerve ganglion apparatus in many cases of lues is equal to the changes in the inner ear typically caused by arteriosclerosis. It is known clinically and anatomically that the internal auditory artery becomes changed very early, if at the beginning of the arteriosclerosis, the symptoms are otalgia angiosclerotica (Stein), bad hearing and noises. The reason for the ear being affected so early must be seen in the fact that the internal auditory artery runs isolated and branchless, as do most of the thinnest arteries in the human body, nearly the length of 30 to 40 mm., and then divided into endarteries. Such an artery reacts very

quickly to all kinds of direct and indirect injuries—therefore, also to arteriosclerosis. Therefore, one manner in which lues causes atrophy of the inner ear can be through endarteritis luetica.

The findings of ectasia of the pars inferior of the inner ear and the sac formation in the vestibule in the author's case of lues are the same as those found regularly in cases of Paget's disease. The cause of the ectasia must be a change in the endolymphatic sac and duct (aquaeductus vestibuli) in the case of lues—as represented by luetic meningitis.

The findings of the complete or incomplete closure of the cochlear aqueduct in the cases of lues are the same as those found in a choked labyrinth caused by brain

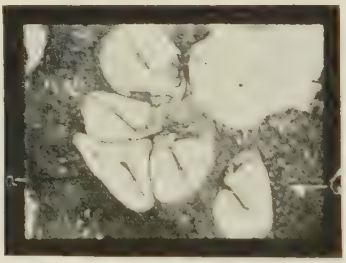

Fig. 39.—Old lues. Otosclerotic foci (a, b) pressing towards the tip of the cochlea (a) and the scala tympani of the vestibular part (b).

tumor. Any case of lues in the cochlear aqueduct is therefore the end-result of the luetic meningitis, pachymeningitis and encephalitis.

Of both practical and theoretical value is the finding of gumma in the inner ear capsule in cases of lues, resembling the changes in otosclerosis. (Figs. 39, 40, and 41). These findings demonstrate that the opinion that otosclerosis may be caused by lues is entitled to consideration; and this finding leads the author to believe that

(1) in the future he will use antiluetic treatment with neosalvarsan and hydrargyrum, and also the malaria treatment of Wagner in cases of otosclerosis. (2) It is suggestive that antiluetic treatment is indicated as a prophylactic measure in children with a positive heredity of otosclerosis through parents or other near-blood relations. (3) Also as a treatment for pregnant women with otosclerosis, in order to prevent the progress of the ear disease during the pregnancy. It may also be that this treatment may prevent in the developing embryo the formation of an ear organ of low resistance. (4)

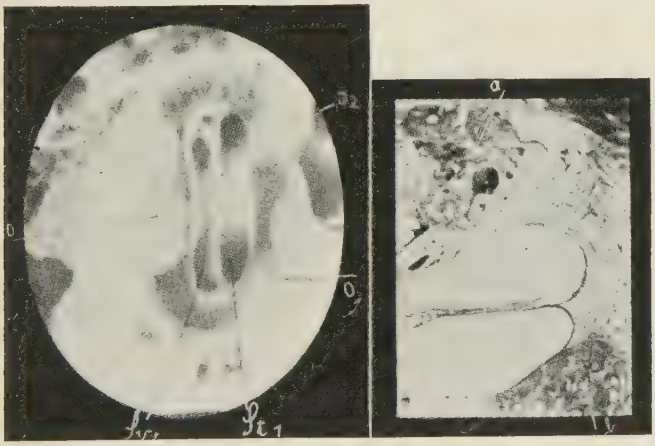

Fig. 40.—(left) Old lues. Cut through the basal coil (St1, Scala tympani; Sv1, Scala vestibuli) of the cochlea with three otosclerotic foci (o, o1, o2).

Fig. 41.—(right) Old lues. Cut through the basal turn of the cochlea with two otosclerotic foci (a, b).

It is necessary, too, that in cases of otosclerosis the antiluetic treatment should be given in the earliest possible stage after the disease has become manifest.

In Case 1 the distance for hearing was very much diminished. The patient heard only very loud words spoken directly into the ear. An old experience has shown that such limited hearing cannot be caused alone

by changes in the conductive apparatus but must also be combined with changes in the perception or nervous apparatus of the cochlea.

The histological findings in these cases show only a very low degree of nerve atrophy and atrophy of Corti's organ only in the beginning of the vestibular part of the cochlea. In all other ways, Corti's organ was perfectly normal from the beginning of the basal coil to the tip. The same normal findings showed in the cochlear nerve and spiral ganglion. One can make this exact histological diagnosis because the preservation of the structure of the inner ear was absolutely perfect.

This finding demonstrates that the great diminution of hearing in this case was caused only by the changes in the bone capsule, and allows the generalization that also extremely poor hearing can be caused by changes in the conductive apparatus alone, with no changes in Corti's organ and in the nerve ganglion apparatus.

Considerations of the Etiology of Facial Paralysis—"à Frigore." The observations in two cases are reported by R. Caussé[2]. Paralysis of the face came on suddenly without pain, deafness or vertigo. The Wassermann reaction was positive, and under antisyphilitic treatment the patient improved, but contracture resulted. After six months, examination showed normal hearing but perverted vestibular response.

The second case resembled the other, except that vertigo and hemicrania accompanied the onset of the facial paralysis. The Wassermann reaction was negative, but the condition improved under antisyphilitic treatment. The paralysis and pain were relieved, but contracture resulted. Hearing and all reflexes were normal, with the exception of perverted vestibular response.

The author believes that facial paralysis complicated by involvement only of the vestibular division of the eighth nerve is a rare combination, but might not seem

(2) Ann. d. mal. de l'oreille, du larynx, October, 1927.

so rare if more vestibular tests were made in cases of paralysis of the facial nerve. He does not agree with Gelle that facial paralysis, "à frigore," is always of auditory origin. While the cause cannot be ascertained in all cases, he believes that syphilitic meningitis and herpes zoster should be considered.

Newer Physical Aids in the Diagnosis and Treatment of Partial Deafness. On the basis of previous experimental work on living animals (Arch. Otolaryng., April, 1926), A. R. Hollender and M. H. Cottle[3] believe that

Fig. 42.—(left) Active electrode over mastoid area of affected ear.
Fig. 43.—(right) Indifferent electrode in position.

diathermy is properly administered when the active electrode is placed behind the external ear—mastoid area (Fig. 42) with the indifferent electrode anterior to the ear on the opposite side (Fig. 43.) Diathermy by this method produces the desired heat generation at the site of the petrous portion of the temporal bone.

The electrodes are held in place by a head band with suitable binding posts for insertion of the electrode rods. The apparatus is very flexible, fitting any head and permitting the placing of electrode not only for the treatment of ear conditions, but also at any site on the head or face. (This arrangement is likewise well adapted

(3) Arch. Physical Therapy, April, 1928.

for the treatment of sinuses or for nerve affections.) Other points to be noted are the milliamperage, duration and frequency of applications and the "follow-up" therapy.

It is seldom that more than 400 ma. are necessary. Usually 250 or 300 ma. suffice. The time for a single treatment is about twenty minutes, after which negative galvanism is given for five minutes. The latter is administered through the same electrodes simply by changing over the cords from the high frequency machine to a galvanic apparatus. The cord leading from the negative pole is attached to the active electrode. The number of treatments necessarily varies and can be determined only by the requirements of the individual case and the progress made. Three applications weekly, on alternate days, should be adhered to, for a lesser number is usually unproductive of favorable results. Improvement, when it occurs, is noted after three or four weeks.

Diathermy, as its name implies, is capable of heating through tissues. It is conversive in nature and is created within the tissue structures. It is, therefore, endogenous. Conversive heat within a part is the most potent factor in production of hyperemia and this results after diathermy administration.

The penetration and degree of heat from diathermy are always under control, but chemical activity is increased in direct relation to increase in temperature. Structural changes in the mucous membrane of the middle ear, or fixation of the ossicles are influenced by diathermy. Absorption of calcified deposits is effected to such a degree that function may be partially or completely restored. By its action on the immediate circulation, its ability to produce hyperemia, intercellular tension is altered and cellular activity stimulated. Exudates and fibrous tissues are disintegrated and muscle spasm relaxed.

For otosclerosis, besides local diathermy, general body

irradiations with the air cooled mercury vapor quartz lamp should be tried. This measure augments the calcium content of the blood and alters general body metabolism. Results in this type of defective hearing are of course extremely doubtful.

Incipient nerve deafness may sometimes improve with local and general measures. When it is possible to remove the etiologic factors, the action of diathermy, synergised with negative galvanism is indicated. Ultra violet irradiations are effective in cases of lowered resistance. The uses of these agents here must be considered purely empiric. If more or less destruction of the nerve exists, the results will naturally be proportionately poor.

The adjuvant action of negative galvanism as a follow-up in the local treatment must not be overlooked. The negative pole is capable of aiding in the softening and relaxing processes which are augmented considerably by a pervious diathermy application.

It should be noted that cognizance is taken of the treatment, both conservative and radical, of any existing rhino-pharyngeal, dental and other pathological findings, particularly those of an infectious nature. Obviously there are definite causes for progressive deafness. Most of these originate as the result of repeated attacks of nasopharyngeal catarrh in childhood. By proper prophylaxis, many cases of deafness could in all probability be prevented.

Two types of tinnitus aurium are recognized, viz: subjective and objective. Only subjective tinnitus is considered.

After determining the relationship of systemic and local causes and correcting them, physical measures should be employed first, alone, or in combination with other remedies. Many patients have tinnitus associated with a deafness of catarrhal etiology of long standing, and in spite of the fact that the pathology is removed or corrected, the tinnitus persists.

When routine measures appear to be inadequate, deep heat should be applied to the auditory mechanism, employing the same technic as in partial deafness. In addition, posterior intranasal diathermy is sometimes of benefit, depending on the extent of involvement in the Eustachian tube.

No claim can be made that diathermy is a specific for tinnitus, nor that it will cure any case. It is, however, a valuable aid in affording relief to many patients, the relief being of longer duration in some than in others. Diathermy alone, without supplementary remedial measures to meet such constitutional indications as may exist, is usually without value.

The tonic effects of ultra violet irradiations to the body occasionally produce indirectly a favorable influence on tinnitus when the underlying factor is metabolic in nature and not due primarily to local aural changes. This form of treatment should be advised as an adjuvant to local therapy, when causes are obscure, or when empiric therapy is indicated for certain reasons.

The following table gives the authors' results in the types of cases mentioned:

TABLE

(For comparative purposes)

Showing results obtained in a series of cases of partial deafness.

	Catarrhal Otitis Media		
	Catarrhal Deafness	*Otosclerosis*	*Nerve Deafness*
Total No. of cases.....	61	29	17
Nasal or pharyngeal pathology	39	6	13
Nose or throat operations performed	35	2	5
No. of cases previously treated by other methods.....	57	25	13
Average No. of treatments..	36—72	54—more	54—more
No. of cases in which tinnitus was present	22	23	15
No. of cases tinnitus relieved	12	9	3
No. of cases in which hearing improved	9*		3*
	12**	3*	2**
	40***	1**	1***

(*) indicates approximately 25% improvement; (**) 50%; (***) 100%.

Velocity Sedimentation Test (Fahreans) in Otology. A. Weiss[4] notes that the accelerated sedimentation of the red blood corpuscles in the bloods of patients sick with infectious diseases has been known for many centuries. The author thought the procedure might be of aid in otological conditions, and after testing some normal individuals, examined 75 otological cases, making 400 tests on these. Among the cases were 30 acute mastoids, 6 subacute, 15 chronic, 1 Ménière syndrome, 4 furuncles of the external canal, 12 acute otitis media, and 7 chronic otitis media.

From his study the author believes that the normal amount of sedimentation for normal male is 3 to 5 per cent; of normal female, 5 to 8 per cent; and for children, 8 to 10 per cent. Acute mastoids, acute middle ear infections, sinus thrombosis, etc., runs values about 30 to 80 per cent. Subacute or recurrent mastoids generally between 20 to 35 per cent, and chronic conditions between 2 to 7 per cent.

If done serially it may serve as an indicator for operations in cases of otitis media with questionable mastoid involvement. Is of minor value in diagnosis, but is helpful as aid in prognosis and treatment.

The Question of Blood Shifting in Otogenous Complications. This report by C. K. Gale[5] is based on the result of over 250 blood counts, in all of which the index of Glasscheib was obtained. The index is based upon the production in the blood of young forms of white cells in acute infections (known as blood shifting, to the left). The relation or ratio of the unsegmented neutrophiles (young forms) to the segmented neutrophiles (mature forms) gives the index. Glasscheib made use of this index to differentiate cases of purulent mastoiditis, perisinus abscess, and sinus thrombosis.

The author's results show the following: (1) The index exists in normal blood counts even when there is

(4) Laryngoscope, February, 1928.
(5) Ibid., August, 1928.

no blood shifting to the left. (2) The value of the index is in direct proportion to the duration of the illness. A high index, especially in cases of streptococcus mucosus, may be present with extensive disease of the mastoid. (3) The index, *per se*, is unreliable in making a diagnosis between mastoiditis purulenta, perisinus abscess and sinus thrombosis. (4) The index as determining the degree of blood shifting to the left has little value in determining the time of operative interference.

The Nose and Throat

GEORGE E. SHAMBAUGH, M. D.

THE NOSE AND THROAT

General Considerations

Unusual Lesions of the Nose and Throat, Including Trichinosis of the Tonsil. L. H. Meeker[1] has found the commonest types of tonsil pathology are hypertrophy and chronic inflammation. Less common are the specific inflammations, as tuberculosis and inflammation due to Vincent's organisms, and occasionally acute tonsillitis.

Variations of these usual forms occur chiefly as accidental sequelæ. Thus, there is the secondary invader, as streptothrix, which requires a primary lesion of the epithelium to gain a foothold. In this manner a persistent granuloma of the larynx was found to be due to streptothrix. In a similar way the so-called mycosis pharyngis was found in the tonsillar crypts. So, too, the changes in the crypts may vary according to the antecedent injury. Small lesions heal without trace and lesions of short duration recover completely. Repeated lesions and extensive injury lead often to scarring, adhesions of the crypt walls, invasion of the peritonsillar tissues, thrombosis of the deep vessels and involvement of neighboring mucous glands.

Among such changes are cysts filled with necrotic epithelium and cholesterol crystals, cholesteatoma or actual stone formation, and tonsilloliths. More rarely the cysts and wall are filled with numerous fine stones or sand formed of calcium salts, like the psammoma bodies of tumors. Rarely, too, the cyst walls undergo a peculiar fatty change to a considerable depth, largely replacing the lymphoid tissue with a deep yellow, fatty material, xanthoma.

Among the unusual findings the author had one ex-

(1) Laryngoscope, August, 1928.

ample of multiple small pigmented nevi of the tonsil. These were recognized in the gross as small black spots scattered under the epithelium of the tonsillar surface and crypts. Isolated miliary abscesses of the tonsil, "follicle abscess," was also encountered. The case of trichina encysted at the base of the tonsil is also unusual (Fig. 44).

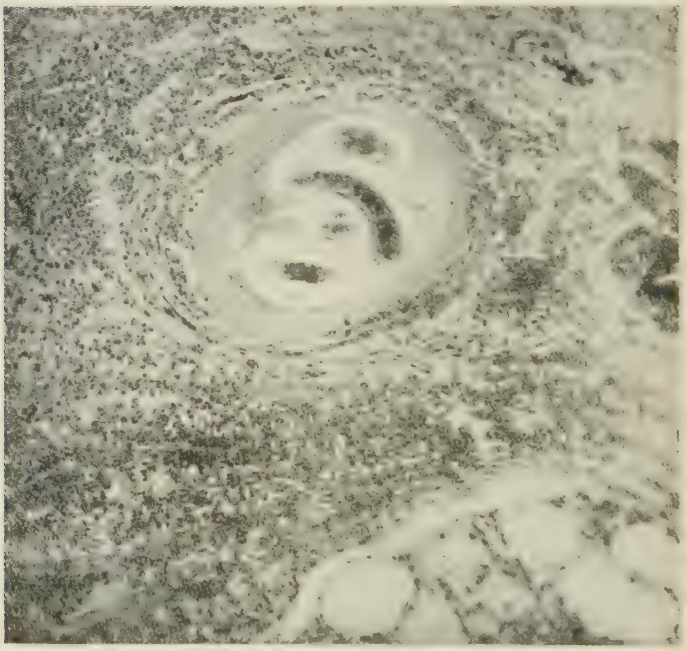

Fig. 44.—Encysted trichina at base of tonsil.

Cysts occur in many localities in the nasopharynx. Less common are those formed by degeneration of large areas in the tissues with the formation of abundant cholesterol crystals. Cholesterol crystals and other deposits, as calcium salts, often act as foreign bodies and give rise to foreign-body granuloma. The author has

had instances of this type of case in the tonsil, nasal polyps, and in the larynx.

Malformations, due to defective embryorial development, may be classed into two main groups: one due to arrested development, later producing cysts; and the other due to displacements of tissue, yielding later tumors; or there may be a combination of both defects.

Among the cysts are those of the nasal septum. Hallinger reported a cyst in the ethmoid plate, considered by him a displaced ethmoid cell, and the author has encountered two in the cartilaginous septum, which he also attributes to ethmoid cell extensions. The turbinate bodies yield occasional cysts, varying greatly in size from a few millimeters to one with a cavity 40x25x15 mm., and lined by ciliated epithelium. Then, there are the fairly frequent cysts from the persistent branchial clefts. Such a cyst is one opening just below the ear and having a wall formed of displaced thymus tissue, including Hassall's corpuscles. Misplaced tissue accounts also for the mixed tumor of a salivary gland removed from the soft palate. A further example, previously reported, illustrates another embryonal anomaly. The right tonsil was entirely replaced by coiled and looped nerve trunks, a plexiform neuroma, a lesion not previously encountered in the tonsil.

The lesions described serve to call attention to certain of the less common pathological processes encountered in the routine examination of a large number of tonsils and miscellaneous nose and throat material.

It may be said that most of these lesions are of minor importance. In several instances, however, the clinical diagnosis depended upon the microscopic findings, notably the trichinae in the tonsil, the streptothrix in the larynx and in the foreign body reactions. In other instances a diagnosis could only be made from a consideration of the embryological development, as the cysts of the nasal septum. Finally the degenerations and metabolic changes may point to a further understand-

ing of the much disputed functions of the tonsils and other nasopharyngeal structures. Sixteen micro-photographs were presented by the author.

[A better understanding of the pathological changes common and uncommon about the nose and throat is very greatly needed by men undertaking to practice in this field. From too many sources we hear the diagnosis chronic tonsillitis, pus in the tonsils, etc., when the careful evaluation of the physical findings brings to light nothing that suggests a pathological condition with the exception, perhaps, of the ordinary cheesy concretions which usually have no clinical significance.—Ed.]

An Analysis of the Reports of Fatalities Following the Use of Local Anesthetics, with a Resumé of Recent Studies on the Subject, Including a Summary of Fourteen Additional Fatalities Not Hitherto Recorded. In this report E. Mayer[2] states that for some unknown reason, procain is still charged with being the cause of a fatality when admittedly cocain had been used immediately prior to the procain, in both instances 10 per cent cocain was applied. The number of cocain deaths should, therefore, be stated as five, over 40 per cent of the number recorded. It is difficult to understand why cocain is used in such concentrations for tonsil operations and the warnings against the use of both drugs unheeded. The proportion of fatalities is exceedingly large when one considers the relative infrequency in which cocain is used as compared to procain. It is the writer's opinion that the proportion of procain used to cocain must be many thousand of the former to one of the latter. At least two of these cases were practically moribund before operation. The author notes particularly the many dentists who use procain without a single fatality. None has any cocain in his office, as a rule. The number of procain deaths is very small, considering the vast amount of it used. In view of the large number of cocain deaths again recorded and the fact that it is con-

(2) Ann. Otol., Rhin. & Laryng., March, 1928.

ceded to be a poisonous drug by the majority of the medical profession, the writer earnestly recommends the cessation of the use of this drug except for examination purposes or endolaryngeal operations, before an accident occurs that would assuredly result in punitive damages, compelling such caution out of self interest if not for the protection of the individual.

Of interest in the series is the death following the use of cocain paste in the pharynx. The death from butyn in such small an amount and concentration, even though associated with an enlarged thymus, is most noteworthy and indicates that it may act as a virulent poison, especially dangerous with such complication.

As thirteen of these deaths occurred in a limited though very populous area, there are no means of knowing whether there has been an increase or decrease of these accidents since the last report. It is noteworthy that not one *single instance* of substitution is recorded in this group, though it was quite frequent in the former. The custom still persists that these deaths are said to be due to status lymphaticus, a definition of which would be most acceptable. That certain individuals are highly susceptible to local anesthetics there can be no doubt, nor is it to be inferred that the operating surgeon might have foreseen the presence of that condition. The fact that fatalities have occurred in the hands of competent and experienced operators is undoubted. Cocain in high percentages is undoubtedly the most dangerous. The author's reports have dealt only with the fatalities, with no mention of the many cases of temporary conditions following the use of local anesthetics, and their publication has stimulated further research.

The appointment of a permanent committee has shown its value in that many questions relative to local anesthesia have been sent to the chairman and these have been invariably answered. The publication of the names of those who have taken part in the investigation

is done to indicate the thoroughness of the study and the independent standing of the individual members of the committee.

All new local anesthetics begin well, as a rule. Time and experience only will tell how safe they are. At present procain seems to be the most reliable and safe among those in general use.

The addition of potassium sulphate to the novocain solution, as recommended by Prinz, is advisable.

It would be better to explain to the patient that there would be slight pain with the first introduction of the hypodermic needle and none thereafter, thus obviating the use of cocain. The danger of substitution should always be borne in mind. As a matter of great value to future investigators, the chemical examination of the anesthetic used in fatalities should always be undertaken. Solutions sometimes become concentrated. The more frequent publication of fatalities is advisable. That local anesthesia has come to stay is undoubted.

[The local application of cocain to the mucous membrane of the nose or throat is of very little risk as compared with the injection of even a small amount of a very weak solution. As complete and satisfactory an anesthesia from cocain for nasal operations is obtained by a 5 per cent solution as by the application of the cocain paste, so-called. If injections of cocain are avoided, and the stronger solutions also discarded, cocain still will constitute our ideal local anesthetic for intranasal work. Before using it, even for an intranasal operation, it is well to know whether the person has an idiosyncrasy. This fact is very easily obtainable.—Ed.]

Influence of Natural Glucosides on the Effect of Cocain. A preparation was sought by G. Jung[3] that would be less toxic than cocain. It should be nonirritating and water-soluble. It must be possible to use it with epinephrin, and it must be able to penetrate the mucosa.

(3) Ztschr. f. Hals-, Nasen-u. Ohrenh., 18:267, 1927-1928.

Various experiments were made on the corneas of rabbits and on preparations of nerve and muscle and the Turk experiment was also made (withdrawal of a frog leg from hydrochloric acid solution). A number of glucosides were tried and finally adonidin was selected as fulfilling these tests. A 1 per cent solution of adonidin with a 2.5 per cent solution of cocain was sufficient for most operative work on the nose. With a 10 per cent cocain solution, it was sufficient for most laryngeal work.

The convulsive action of cocain was counteracted by the adonidin, and the stimulation of the heart by the adonidin was counteracted by the cocain. It also acts synergistically with procain in nerve block.

Ceanothus Americanus. The following results were obtained by A. A. Giordano and D. L. Wilbur[4] in a series of studies on sixty-two medical students:

1. The alkaloids of *Ceanothus americanus* definitely reduce the coagulation time in the normal person. Observations show this to be a reduction of about 20.5 per cent. In this respect, the authors' results differed from those of Groot and Thoraldsen and Krawetz. The former found the reduction to be 31 per cent when the capillary tube method was used, while the latter found it to be 41 per cent when the venipuncture method was used. All of their results were obtained with doses larger than those used in the present series. The authors found that doses larger than those used did not materially change the coagulation time in their group of cases.

2. The maximum effect seems to be obtained within one-half hour and to last through a period of one hour, after which a return to normal comes on rapidly.

3. The dose of 2 5 gave a maximal effect; a larger dose did not materially depress the coagulation time to a greater extent.

4. Therapeutically, therefore, it would seem that the best advantages to be gained are by giving a dose of 2

(4) Arch. Otolaryng., June, 1928.

3 and repeating this hourly in order to produce a continual maximal effect.

5. While preparations of *Ceanothus americanus* do have the effect claimed for them, no one should expect to prevent or check hemorrhages by the use of this drug alone. It may be used as a possibly helpful adjuvant, but not to the extent of neglecting accepted precautions and, when hemorrhages do occur, adopting prompt and energetic surgical procedures.

The Management of Malignancies. From his extensive experience J. C. Beck[5] believes that in surgical diathermia we have a destructive surgical agent which is decidedly lethal in its action upon malignancy.

Until the specific etiologic factor in the production of malignancy is established, the cure of cancer is dependent upon radical surgery and irradiation. A sufficient number of cases of cancer cured by surgery and irradiation are on record to encourage the writer in the continuance of the management of these cases in this manner. The cooperation of the various specialties are indispensable in obtaining satisfactory results.

Prevention of latent hemorrhage following surgical diathermia is effected by prophylactic ligation of the external carotid and gradual compression ligation of the common carotid. Pain before, during and after operation may be best controlled by nerve block with alcohol or even gasserian ganglion root resection. Statistics are only of value when the reporter and his results are under the supervision of an association such as, for instance, the American Society for Control of Cancer, because statistics as now gathered are of distinct personal equation.

Electrothermic Methods, Roentgen Rays and Radium in the Treatment of Malignant Diseases of the Eye, Ear, Nose and Throat. Malignancies of the mouth are of the squamous cell type, that is the type of growth whose abnormal cells are of great resistance

(5) Ann. Otol., Rhin. & Laryng., March, 1928.

to irradiation. The rule is metastasis and death, if neglected. The indicated treatment, according to J. T. Stevens[6], consists of thorough roentgen irradiation of the site of the growth and of all of the regional lymphatics draining it. The growth is destroyed and removed by electrothermic methods and radium needles are buried deeply into the coagulated base. Later, roentgen ray treatments are again instituted.

When the tongue and tonsils are involved, before operation by electrothermic methods is attempted the lingual or external carotid arteries must be ligated; otherwise, fatal hemorrhage may appear at the time the slough separates—in from 10 to 14 days.

Sarcoma and carcinoma of the antrum have been observed by the author. Treatment of these diseases always begins with thorough irradiation of the antrum and all of the draining lymphatics with roentgen rays. Two weeks later this is repeated. In a few cases the disease has been practically eradicated by such treatment; sarcoma generally giving the most striking results. If signs of definite improvement are not noted soon after treatment, destruction and removal of the diseased tissues is indicated. For this operation there are two routes: through the roof of the mouth, that is the floor of the antrum; or the cheek over the diseased side can be turned back and entrance to the antrum gained through its anterior wall. The latter is the route which the author prefers, but, quite naturally, the patient generally prefers the other because no damage is done to the face and deformity of the roof of the mouth can be nicely repaired by a dentist. Following removal of the disease, radium is packed into the sinus and treatment is completed by several postoperative roentgen ray courses.

As regards the larynx, if the disease is localized to a small enough portion of the larynx to permit of complete removal, electrothermic methods following pre-

(6) J. M. Soc. New Jersey, February, 1928.

liminary irradiation would appear to be one of the best methods of management. This is probably best done by laryngofissure, because one skilled in electrothermic methods might not be equally skilled in the manipulation of the laryngoscope. Whichever route is used the work must be completed by several postoperative courses by radiation therapy.

In ear malignancy, if epithelioma of the skin of the auricle is treated thoroughly and skillfully by electrothermic methods and radiation, recovery is almost certain. If the cartilage is involved, none but the most skillful and thorough treatment can effect success. In this stage of the disease it is undoubtedly best to remove the entire auricle by electrothermic methods and to thoroughly irradiate the ear and the cervical lymphatics. When the bone is involved, or cervical metastasis has taken place, permanent recovery is the exception, the best of treatment being seldom followed by more than palliation.

Primary malignancies of the middle ear are very rare. At the Basle clinic, out of 45,000 ear cases only 6 had primary malignancy of the middle ear. However, these cases being of the squamous cell or squamous cell adenocarcinoma type very thorough treatment is indicated. In most cases probably the diseased bones had better be destroyed and removed by electrothermic methods and radium packed into the wound against the coagulated base. Roentgen rays are indicated for irradiation of the site of the disease and the lymphatics draining the region.

Carcinoma, sarcoma and glioma are found upon or within the eyeball. If small and accessible there is probably no better method of treatment than to remove the lesion by the electrothermic methods, the operation being preceded and followed by either roentgen ray or radium therapy. These growths should give nearly as good results as malignant lesions of the skin. Great skill is needed here and it is possible to remove these

lesions and leave very little scar, sometimes with no impairment of the function of the eye.

Injection of the Parotid Gland with Iodized Oil. It occurred to H. M. Keith[7] that iodized oil might be of value in determining the condition of the ducts of the parotid gland. Accordingly the author made use of this procedure in a case of a girl aged 13, who had had

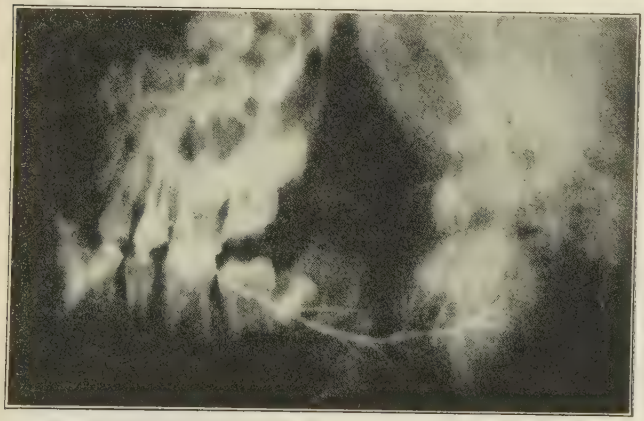

Fig. 45.—Normal parotid gland injected with iodized oil.

a swelling at the angle of the jaw each morning after having the tonsils and adenoids removed 6 years previous. An *x*-ray picture taken immediately after injection showed dilated ducts, particularly in the hilum of the gland, and irregular globular dilatations in the periphery (Fig. 45). As a control a similar picture of a normal gland was made (Fig. 46).

According to the author injection of the parotid glands with iodized oil is carried out with from 0.5 to 1.5 c. c. of the oil, using a 10 c. c. syringe and a steel needle of 18 gage, with a rounded point.

With this method, the iodized oil will penetrate into

(7) J. A. M. A., April 21, 1928.

the finer ducts of the gland, under moderate thumb pressure only.

In a normally secreting gland, the iodized oil is removed within twenty-four hours. The anatomic relations of the parotid gland can be demonstrated in a roentgenogram by this means, and abnormalities in the size and shape of the ducts can readily be made out. No distress is noted at the time of injection. Up to the

Fig. 46.—Injection of dilated parotid gland with iodized oil in case reported.

present time, five months since the injection, the author's patient has noted no untoward result, and there has even been improvement on the affected side.

Nasal and Oral Focal Sepsis in the Etiology of Gastro-Intestinal and Pulmonary Infective Diseases. The term "focal sepsis" is usually applied in its *clinical* sense to established pyogenic infection such as occurs when an initial infective invasion, having overcome systemic and tissue defensive reaction, persists as a chronic localized infection. Nevertheless in patients with nasal passages choked with polypus, or copious

purulent gingivitis round the necks of living teeth, or periapical dental abscess, one often looks in vain for systemic complications; the copious outpouring of polymorphonuclears seems a measure of successful local resistance to the focal infection. Chronic bacterial toxemia and subinfection is most prone to arise from chronic *latent* focal infections, such as frequently occur in nasal sinusitis, with *relatively* nonpurulent discharge (sinus infection without pus in some degree does not exist), or periapical dental sepsis, often with no pus at all. Hence the existence of a casual focal sepsis in pulmonary or gastro-intestinal infection is often to be discovered only by careful investigation.

Sepsis of the mouth, pharynx, and nose may, according to P. Watson-Williams and F. A. Pickworth[8], affect the lower respiratory tract or gastro-intestinal tracts (*a*) by direct spread of infection along the mucous membranes, through the larynx and trachea; (*b*) by the blood stream or lymph-vascular infection; (*c*) by inhalation of septic particles or secretions, or by the swallowing of enormous numbers of organisms.

That patients may swallow immense numbers of septic organisms with impunity is certain, for the normal acid gastric secretion is a potent antiseptic barrier; but if the mass infection is continued it fairly frequently results in gastric catarrh or gastritis, with hypochlorhydria, constipation, diarrhea, or recurring colitis. It would seem likely that naso-oral infection may originate local gastric or duodenal ulcers; or, by spreading through a relaxed sphincter of Oddi, cholecystitis and gall-stones; or, as more commonly appears to happen, appendicitis. Again, such gastro-intestinal infections may be *indirectly* determined by toxemia with resulting endocrine exhaustion.

In cases of infection through the blood stream pyogenic organisms apparently display an elective affinity for the regions involved—for example, the gastro-in-

(8) Brit. M. J., June 2, 1928.

testinal tract—which the researches of Rosenow have gone far to explain and to prove.

It appears, at any rate, a reasonable assumption that, in many cases, a chronic subinfection is commonly set up in the gastro-intestinal tract, although in many a patient a relative auto-immunization renders him merely a "carrier" until, perchance, exposure to cold or some intercurrent factor determines an exacerbation of what is really a long-standing infection.

It seems probable that appendix infection results from swallowed organisms, for there the intestinal contents are normally alkaline, while infective gastro-duodenal ulcers are often blood-borne, and thus the frequent concomitance of appendicitis and gastro-duodenal ulcers of infective origin might be explained.

The authors demonstrate specimens of sphenoidal sinusitis that illustrate what might be justly termed a "human parallel of Rosenow's experiments." In this case a chronic diplococcal infection has been traced, invading the sinus mucosa *from the surface*, and spreading to the pituitary capsule and gland; in the same case similar diplococci are also demonstrated in the *deeper* layers of the evenly spaced hemorrhagic patches in the gastric mucosa. Furthermore, in this, and other specimens the diplococcal infection, traced to the pituitary, explains the evidences of endocrine disturbance, since the superjacent hypothalamus is the region held to control many of the basal matabolic processes. These observations corroborating similar researches by Logan Turner, Reynolds, and others, point to infection by the blood stream as being the most likely pathway of many subinfections, rather than infection by inhaled or swallowed organisms. Why organisms in the blood stream should have an elective affinity for certain regions or organs is not known, but that such elective affinity is shown Rosenow's researches leave little room for doubt. Furthermore, this same elective affinity of certain strains of infective organisms for certain tissues is sup-

ported by clinical experience—as, for instance, in epidemic influenza, which in one epidemic tends to involve the lungs, in another the gastro-intestinal tract, and in yet another shows a proclivity to cerebro-spinal complications.

The authors also stress the influence of naso-oral infection on lung conditions. Three cases are presented which, from their long and varied histories, seem to show definitely that the nose and throat infection was the causal factor in the neurological, pulmonary and abdominal conditions.

The writers believe that if these naso-oral infections do cause such serious complications, their early recognition and prompt removal may prevent these subinfections of the pulmonary and gastro-intestinal tracts.

[Since the question of focal infection as an etiological factor in producing systemic disturbances has been under discussion, there seem to be those who find no limitations either as to the types of systemic conditions which can be caused by the focal infection or as regards the conditions, particularly in the nose and throat, which may be held responsible as the focus for systemic disturbances. Because a frank positive purulent focus of infection is infrequently demonstrable in cases of these supposed systemic conditions, it has been contended that conditions other than these, where the pathological conditions are palpably insignificant, are the most frequent causes for systemic disturbances. A small nodule of lymphoid tissue, for example, developing in a tonsil fossa after successful enucleation is considered by Dick a more dangerous focus than when the tonsil is in situ. Apical infection without demonstrable abscess formation, in other words without any really demonstrable pathology, is seized upon as a justification for removal of healthy teeth because of systemic infection, and, finally, we hear that it is the intangible undiagnosable sinus conditions, where there is no demonstrable pathological secretion, in which there lurks the more serious danger

of systemic disease. Are we not losing sight of the fact that the same conditions which involve the mucosa of the sinuses affect much more frequently the mucosa of the nasal passages and are the physical conditions in the sinuses such that the non-secretory involvements of the mucosa are more likely to produce systemic infection than are similar involvements of the mucosa of the nasal passages, naso, oro, and hypopharynx, and for that matter the mucosa of the bronchii and the intestinal tract, for all are likely to be involved in the chronic inflammatory process? If it is proper to eradicate, that is, to eviscerate the mucosa lining of the sinuses in situations of this sort, why isn't it logical to propose exenteration of the mucosa of the nasal cavities, and where is this going to lead us? There is no logical place to stop in this sort of treatment. I suspect that the interests of the patients are conserved best, if we treat by surgical measures those sinus diseases where local findings warrant operative measures perhaps quite irrespective of any confusion with the problem of possible systemic disturbances.—Ed.]

The Location of the Focus in Optic Nerve Disturbances from Infection. Some focus in the body is responsible for the optic nerve lesion arising from infection. L. E. White[1] believes the invasion is through the blood stream. The accessory sinuses supply but an insignificant number of the foci; most are found in teeth and tonsils. The sinuses, from their priority of investigation, have occupied the attention of rhinologists too long to the exclusion of other more frequent seats of infection. Much can be learned from the general medical man on the best methods of investigating focal infection.

Dental infections are easily overlooked. An expert odontologist is essential in a successful search for dental pathology. Devitalized teeth are a potential source of infection. Tonsils frequently are and should

(1) Ann. Otol., Rhin. & Laryng., March, 1928.

be removed when at all suspicious if no other foci are found. The antrum among the sinuses is the most frequent seat of infection. Thickening of the antral mucosa without secretion may be a sufficient focus to warrant surgical intervention. Definite infection in the other sinuses should be eliminated, but this is of rare occurrence. Marked nasal blocking should be removed. Ventilation of the sphenoid as a therapeutic measure is rarely indicated, but is still advocated when optic atrophy is imminent.

The infection may be in remote regions of the body. The focus may be found in the appendix, gallbladder, prostate, fallopian tubes, genito-urinary or intestinal tracts. Systemic infection following influenza, scarlatina, etc., may be responsible for the optic nerve lesion. Local treatment is advocated in addition to the removal of the focus.

Normal vision was obtained in 63 per cent of the cases undergoing operations, while 20 per cent improved. In the remaining 17 per cent, which were chronic, further loss of vision was prevented. The ethmoids were opened but once, the sphenoid twice and the antrum four times. Over 80 per cent of the cases had infected teeth or tonsils or both.

[The writer calls attention very timely to the fact that optic neuritis, when resulting from infection, is like the involvement of other nerves, a blood stream infection, and rarely results as an extension from sinus disease. The dictum that in cases of optic neuritis the matter is such a serious one that one should operate on the posterior ethmoid and sphenoid, even where no palpable evidence is found suggesting infection, is wrong. The trained rhinologist as a rule has no difficulty in diagnosing such involvement of the sinuses as would constitute a possible focus for systemic disturbance.—Ed.]

Aseptic Cavernous Sinus Thrombosis. H. C. Todd[2] reports the case of a colored boy, aged 15, who developed

(2) Arch. Otolaryng., August, 1928.

a somewhat painful swelling and effusion of the left eye and orbit. The right eye also became involved. Increased intracranial pressure was indicated by a pulse rate of from 52 to 56 and enormously engorged veins in both fundi. The writer advised subtemporal decompression. This was done and full recovery took place in seven months.

The author believes that the etiology as based on his discussion of thrombosis two years ago will explain these conditions. The patient undoubtedly developed first a

Fig. 47.—Condition of patient two weeks after entrance to the hospital. Note the conjuctiva protruding below the margins of the closed lids of the left eye.

mild infection of the sphenoid, sufficient to cause an inflammation of the contiguous cavernous sinus, the intima of the cavernous sinus throwing out sufficient exudate to pick up the red and white blood cells and blood platelets to produce a thrombus. Fortunately, the sphenoidal sinus has a rather large opening for natural drainage, and, in case of infection, always tends to spontaneous cure. Resolution took place naturally,

therefore, in the sphenoidal sinus, before the infection had broken down the membranous walls of the cavernous sinus to permit the bacteria to infect the thrombus. Such good fortune is impossible in lateral sinus thrombosis from purulent mastoiditis, but should be accomplished quite readily in cavernous sinus thrombosis through the natural drainage of the sphenoidal sinus.

From his observation of this case, the author believes, however, that the safety of these patients could be greatly increased by the prompt administration of some intranasal treatment that would favor natural drainage of the accessory nasal sinuses, such as keeping the nasal mucous membrane shrunken with a 1 per cent solution of ephedrin or 1:1,000 epinephrin hydrochlorid, followed by a gentle and persistent intranasal application of a hot alkaline douche.

Figure 47 tells one more at a glance than pages of descriptive writing could possibly do, especially as to the appearance of a patient with cavernous sinus thrombosis.

Osteomyelitis of the Frontal Bone. In reporting four cases V. Dabney[3] points out that the certain prevention of a disease depends on knowledge of the specific cause. Thus a serious problem is encountered in combating osteomyelitis, the etiology of which is still a matter of dispute, although several plausible theories have been presented. In the long bones, where this disease has been fairly common for many years, trauma and hematogenous infection usually have been considered the causes. However, even here where demonstration is somewhat easier than in the frontal bone, the author believes there is doubt in certain cases as to where the infective agent arose. Hastings reports a case of acute diffuse osteomyelitis of the frontal bone in which it would appear likely that the focus was of dental origin, and hence, hematogenous. Lynch is the originator of the theory that osteomyelitis is caused by stripping up

(3) Arch. Otolaryngol., August, 1928.

the periosteum and the subsequent trauma of the radical operation. However, he fails to account for the fact that some of the men who have been performing this operation for many years have not had any cases until recently, and others have had few at any time.

The author believes that the greatest cause of all, when osteomyelitis follows another operation, is failure to remove all necrotic material, which is thus pressed against denuded bone, the nutrition of which has been almost destroyed temporarily. The wound is deprived of air by the suturing of the soft parts over it, and the drainage is limited to the opening into the nose. It is not remarkable that reinfection should occur, and is a more reasonable cause of osteomyelitis than merely lifting up of the periosteum on the external frontal wall. In those cases in which the osteomyelitis is acute and not the sequel of another operation on the sinus, the author believes the etiology lies in one or all three of these causes: (1) trauma, (2) long continued contact of infective material in an undrained cavity and (3) hemolytic bacteria, generally the streptococcus. All his cases have showed this type of infection. It is within the past nine or ten years that this increase in osteomyelitis of the frontal bone has been encountered, and this period coincides with that following the pandemic of so-called influenza, which sent thousands of carriers of the hemolytic streptococcus all over the world to disseminate this deadly organism. In a paper entitled, "A Scourge of Hemolytic Streptococcus," the author directed attention to the enormous increase in the number of cases of mastoiditis necessitating operation with this organism as the basic cause, which gave rise to the cases variously termed hemorrhagic, coalescent or hemolytic. Up to that time, such cases had been rare in his experience; they not only were no longer so, but actually became common. He attributed this to the dissemination of the bacteria by the thousands of carriers who were everywhere. To the list of the possible causes,

Hastings has added the hematogenous, and it must henceforth be included in the etiology, as his case is convincing.

The author's four cases present material for proving almost any or all of the various forms of etiology thus far offered, if one chooses to see his own theory in them. In fact, one of them alone could be used to show every one of the theories, or that has been suggested by any one. Of course, tuberculosis and syphilis, the twin bane of all investigators in etiology, are not considered, as they are basic and are taken for granted. Moreover, they were not present in his cases. To open an osteomyelitic process and leave it wide open and drained until a sequestrum has formed and the delimiting process has been established cannot be questioned as a good surgical procedure in cases involving the long bones, but in the frontal bone, the problem is somewhat different. Here the virulent infective material is left in contact with so poorly resistant a region as the cribriform plate of the ethmoid, and the thin inner frontal plate separates it from the brain. The author lacks the courage to use this procedure, even if he were convinced that it might help matters, and he is yet far from being so. He prefers to remove all softened bone and leave a wide open wound, though this might prove to be the same thing, as it is not possible to be sure that all diseased bone has been removed.

A Case of Acute Osteomyelitis of the Superior Maxilla with a Large Infra-Orbital Abscess in a Nursing Infant. G. Merelli[4] reports a case of an infant, aged 3⅓ months, who showed an enormous edema of the right lower eyelid of rapid onset. The mother said that for three days, without any known reason, the infant had refused food, vomited and had diarrhea. At the same time, the swelling was noticed.

General physical examination gave negative results, aside from an acute inflammation of the gastro-intestinal

(4) Riv. oto-neuro-oftal., July-August, 1927.

apparatus. External examination of the face showed that the right lower eyelid was reddened and edematous, so as to close the palpebral cleft completely. Palpation gave a sense of fluctuation, more especially toward the external part of the orbit. The right cheek showed a swelling and redness corresponding with that of the upper part, though in less degree. Signs of acute inflammatory processes were not seen in the nose. A marked painful swelling was found in the mouth; in the zone corresponding to the hard palate on the right side was a fistula from which came pus and in which a probe was passed for several centimeters against necrotic bony tissue on the right alveolar margin. A diagnosis was made of acute osteomyelitis of the superior maxilla.

Operation was done under local anesthesia through a deep incision in the gingivobuccal fold, with drainage and packing. The postoperative course was good, and the symptoms rapidly subsided. The fistula closed.

The author states that acute osteomyelitis of the superior maxilla in nursing infants and in the newborn is rare. In discussing this case, he states that the diagnosis is difficult, but that later the condition gives a characteristic triad: (1) swelling of the cheek of the alveolar margin and that side of the palate, (2) the presence of superficial abscesses and fistula in characteristic points and (3) expulsion, also spontaneous, of tooth buds and bony sequestrums.

The author mentions the importance of differentiating this condition from phlegmon of the orbit, from purulent ophthalmia and from dacryocystitis. He says that the prognosis is always grave because the mortality is often serious, being from 30 to 50 per cent. Septicemia with purulent visceral localization is always a frequent complication. In the most benign forms, the process tends to become chronic and suppuration continues for months.

Cases like the author's in which complete cure comes quickly, are rare.

In regard to operative intervention, which must always be early, Broca distinguishes the cases in which fistulization has occurred and those in which it has not occurred. In the cases in which fistula exists, Broca advises cleaning up the abscess and taking away the sequestrums and granulations to give ample drainage. On the other hand, in any case in which fistulization has not occurred, the incisions usually made across the cheek are contraindicated on account of the deformities and those through the nasal cavity are also contraindicated because they are dangerous and difficult to perform in infants. The point of election in which to reach the various places of infection is the gingivobuccal sulcus. One of the most important principles of general operations in osteomyelitis is that of opening the various zones of infection, as much as possible.

The Sensory Field of the Facial Nerve. In reporting four typical cases S. L. Ruskin[5] notes that in tumors of the cerebellopontile angle or acusticus tumors, involvement of the sensory root of the facial nerve may be an early symptom, simulating neuralgia of the nasal ganglion and giving rise to a burning sensation at the tip of the tongue, disturbances of taste along the side of the mouth, a fulness and scratchy feeling in the throat and itching of the roof of the mouth. The symptomatology may occur with other lesions affecting those fibers of the facial nerve that pass through the greater superficial petrosal nerve. Also, the pains in the posterior half in Sluder's syndrome are probably due to the sensory elements in the facial nerve. One may consider the symptomatology described as part of the intra-oral representation of the facial nerve. The cases also give clinical proof of the academic statement that the greater superficial petrosal nerve carries taste fibers by way of the nasal ganglion, and that lacrimal fibers

(5) Arch. Otolaryng., April, 1928.

(cranial autonomic) are carried by way of the greater superficial petrosal nerve and the nasal ganglion.

An Approach to the Problem of Pain Fields, with Special Reference to Those Associated with Diseases of the Nose and Throat. The symptoms of diseased conditions of the spheno-palative ganglion are divided by F. H. Pike[6] into three groups: (1) Pain in the peripheral area supplied by branches of the fifth cranial, and possibly the seventh cranial, nerve which pass by the ganglion or through other diseased regions of the nose and the sinuses. To this pain should be added the glandular effects due to stimulation of the autonomic or other secretory fibres passing through or arising in the ganglion. (2) Pain in regions remote from any area innervated by the fifth or seventh cranial nerves. The sensory distributions of some branches of the upper cervical nerves are cases in point. (3) Symptoms appearing in the cardiovascular, gastro-intestinal and genital systems.

The explanation of the first group of symptoms appears reasonably clear. It is a cardinal principle of physiology that a nerve may be stimulated at any part of its course. In the case of a somatic sensory fibre, the sensation is referred to the peripheral distribution of that fibre. Pain in the knee from irritation of the trunk of the obturator nerve in tuberculosis of the hip joint is a familiar clinical illustration. The tingling of the fingers when the ulnar nerve is struck against a sharp corner is familiar to all. That inflammatory processes involving a sensory nerve trunk may give rise to pain seems equally clear. Whether or not the branches of the fifth and seventh cranial nerves actually pass through the ganglion or merely go by the sphenopalatine ganglion does not appear so significant for the explanation of the pain. The fact remains that these nerve trunks lie in the diseased region. Head's figures showing an

(6) Laryngoscope, April, 1928.

area of pain in the region of the eyes in disease of the sinuses is understandable on this basis.

The explanation of the second group of symptoms demands a more extended search. Head shows an area of pain at the back of the head and upper part of the neck as symptomatic of sinus trouble or diseased teeth. It is this pain, remote from the diseased region or from the peripheral distribution of any of the nerves passing through it, which is puzzling.

If one follows out the field of lymphatic drainage from the sinuses and other nasal structures, it is found to lead down to the external and internal jugular or other secondary lymphatic chains on its way to the deep cervical chain of lymphatic glands. Drainage from the teeth, tonsils, the nose and its sinuses finally comes down into the common descending chain of deep cervical lymphatics. The case reports tell of nodules which may be felt in the sternocleido mastoid, the trapezius and the levator anguli muscles and strongly indicate the presence of enlarged glands in these regions. There is ample clinical evidence to support the view that enlarged lymphatics may give rise to pain. Hilton recognized pains in these regions as due to lymph gland involvement many years ago. The pain in the neck and shoulders may not be coincident with the onset of the nasal condition, but may come on days or weeks later. The pain in the region of the peripheral distribution of the cervical nerves may occur at a time when there is no pain whatever in the nose or eyes. It seems more reasonable to attribute the pain in regions remote from the nose to inflammatory or other pathological processes involving the nerves at those points in their course which lie close to the enlarged lymph glands than to some mysterious effect transmitted to the cervical nerves through the devious and even nonexistent connections of the sympathetic system.

The Sphenopalatine Ganglion. A. I. Feldmann and M. F. Ivanitzky[7] conclude the following:

1. The sphenopalatine ganglion is the local nerve center of the nose. It is frequently subjected to disease and should engage the serious attention of rhinologists.

2. For success in reaching the ganglion subcutaneously, an exact knowledge of the surrounding osseous structures is required.

3. In an investigation of the anatomy and topography of the ganglion, in addition to the usual methods, craniometric methods, roentgenography, transparency (Spalteholz) and elective staining of the tissues (Worobjew) must be employed.

4. The measurements of the pterygopalatine fossa are: anterioposterior diameter 6.2 mm., transverse diameter 9.1 mm. and height 18.3 mm.

5. Instead of the terms foramen opticum and foramen rotundum, the terms canalis opticus and canalis rotundum should be used.

6. The sphenopalatine foramen and the axis of the pterygoid canal lie on a horizontal plane.

7. The axis of the pterygopalatine canal does not form a straight line. It is frequently bent at an angle.

8. The palatine foramen is directed not only inward but forward.

9. The shape of the skull determines also the form of the pterygopalatine fossa, to a certain extent, and the direction of the adjacent channels. In persons with brachiocephalism the pterygopalatine canal is more vertical than it is in persons with dolichocephalism, in whom the upper end deviates considerably backward.

10. The position of the ganglion is either more sagittal or more frontal.

11. The methods of reaching the sphenopalatine ganglion subcutaneously by way of the orbital, oral or nasal cavities are either not aseptic or dangerous, be-

(7) Ztschr. f. Hals-, Nasen-u. Ohrenh., Dec. 22, 1927.

cause vital organs in the orbital cavity may be injured. Besides, in many instances, they cannot be used.

12. The external method remains. In order to reach the ganglion, a needle which is slightly curved at the end is used. All other methods do not allow one to reach the ganglion, but only the lower portion of the fossa. They permit only an infiltration anesthesia.

13. With all methods of reaching the ganglion, an exact knowledge and observation of the depth and of the distance for the outer points is imperative. In 100 skulls, the distances were:

From the external lower angle of the orbital cavity	50 mm.
From the lower border of the zygoma	52 mm.
From the angulus frontotemporalis ossis zygomatici	47 mm.
From the middle of the upper border of the zygomatic process	50 mm.
From the spina nasalis anterior	58 mm.
From the foramen palatinum majus	28 to 30 mm.

Approximately 5 to 7 mm. must be added on account of the thickness of the soft tissues.

The author uses a straight needle, from 7 to 8 cm. long, which is slightly curved at the end. A pin indicates the direction of the curve. The opening of the hollow needle is on the side and at the very end of it. The needle is introduced under the anterior end of the zygomatic process, inward, forward and downward. The tuber maxillaè indicates the direction. The tip of the needle is always in such a position that the outer curve is directed forward and the inner curve backward. When the outer curve glides over the tuber maxillae the needle reaches the pterygoid canal and presses against it.

Persistent Hiccough: Control by Cocainization of the Nasal (Sphenopalatine, Meckel's) Ganglia. J. B. Coston[8] reports the case of a man, aged 55, who had begun to hiccough five days previous after eating a full meal. All of the usual therapeutic measures failing, the author resorted to cocainization of the nasal ganglion. Prompt relief occurred, but was temporary. About four

(8) Ann. Otol., Rhinol. and Laryngol., September, 1928.

applications were made on each side of the nose and following this permanent relief was obtained.

The onset of the attack in this case is definitely associated with distention of the stomach, with fluid of alcoholic nature, a most frequent original cause. This simple inciting factor, of peripheral origin, was removed undoubtedly by gastric lavage and enemas, the first treatment used. What continued the mechanism after such a factor was removed? All that apparently remains is the cycle of events in this hiccough.

The two movements in hiccough are the inspiratory excursion of the diaphragm and the closure of the glottis. This violent closure of the glottis may furnish enough sensory shock to precipitate the next contraction of the diaphragm. The effort in all kinds of treatment is to break up this reflex in the sympathetic system.

In this case and the others referred to, the author has been able to interrupt the cycle by blocking the nasal ganglia, and it appeals to him as a corollary to the relief of laryngeal pain (Sluder) by the same means; that sensation from the larynx may traverse this same route to set off the next spasm of the diaphragm, as accessory stimulus to the next reflex action.

If the original irritation of the diaphragm is peripheral, and removable, it seems that blocking of the ganglia would succeed in more cases than if the source of the spasm is central, where direct irritation of the phrenic nerve continues. Further observation will show if there is any difference in results in the two classes of cases.

The cessation of hiccough did not occur until the second of the two ganglia was treated.

The Roentgen Ray as an Aid in the Injection of the Sphenopalatine Ganglion. In this series of cases O. H. Homme[9] introduced the needle through the posterior palatine foramen, according to the method of Dr. Simon

(9) Arch. Otolaryng., June, 1928.

L. Ruskin. Ruskin used a straight needle in the posterior palatine canal. In some of these cases the writer used the straight needle in the canal and in others the slightly curved needle. In the course of his present studies, it became apparent that if the needle were slightly curved along its whole extent, it would more

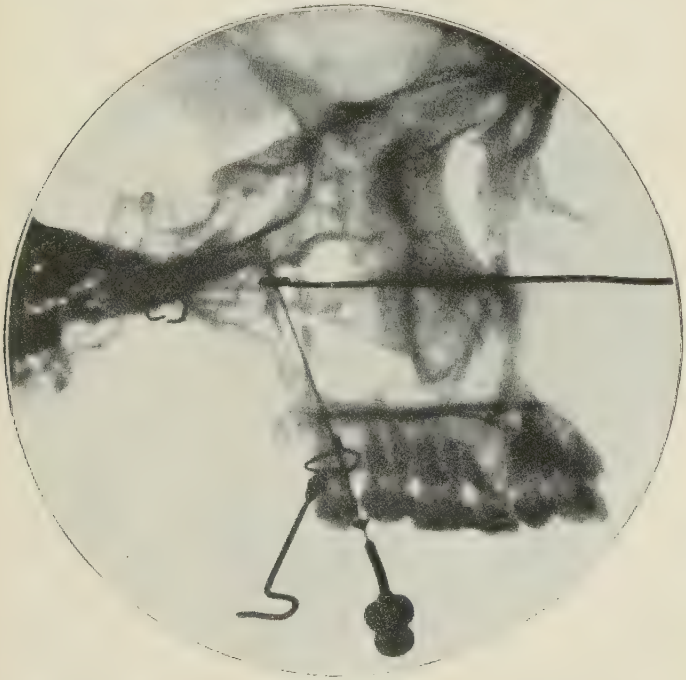

Fig. 48.—Study of the skull with a probe in the pterygopalatine canal and one hooked in the sphenopalatine foramen through the middle meatus of the nose. *a*, Indicates the pterygopalatine canal; *b*, the sphenopalatine foramen.

nearly approximate the sphenopalatine ganglion, as it would more closely follow the pterygopalatine canal and the lateral wall of the nose.

A straight needle was introduced in the nose under the posterior end of the middle turbinate, according to the technic of Sluder, although in the Annals of Otology,

Rhinology, and Laryngology, he stated that the approach of the ganglion through the sphenopalatine foramen is less difficult and more trustworthy. (Fig. 48).

The author does not advise the use of both Sluder's and Ruskin's methods at the same time on the same patient. However, by using both methods at the same time and reading roentgenograms of anteroposterior and lateral views, one could inject whichever needle is apparently nearer the sphenopalatine ganglion. Better localization can be obtained when needles are in place in the nose and in the pterygopalatine canal. When it is not feasible to insert both needles, because of obstruction in the nose or because of not wishing to prolong the operation in the way of discomfort, a roentgenogram taken with the method used would be a distinct aid in the operation.

One Hundred Cases of Apparently Cured Pollen Hay-Fever. According to I. C. Walker[1] these 100 patients have probably been cured. All have been without symptoms for a period of two years, and 78 have gone three or more years without treatment.

In 22 cases the cutaneous test with the causative pollen was changed from markedly positive to negative; in 22 others the cutaneous test was only very doubtful when treatment was discontinued; in three others the test was positive only with the whole pollen, and in 9 others no greater dilution than 1:100 or 1:500 evoked a reaction. In 44 cases the cutaneous test was not markedly changed.

The patients were treated at weekly intervals for a period of from thirteen to sixteen weeks previous to the usual onset of their symptoms. In all cases careful cutaneous tests were performed with the various dilutions of the causative pollen protein in order to determine with what dilution or strength of pollen protein treatment should be begun, and furthermore, because such tests are a guide in determining not only the suc-

(1) J. A. M. A., March 10, 1928.

cessive increases in the dosage but also what may be considered satisfactory treatment for each patient.

When the pollen test becomes negative, it seems to be safe to stop hay-fever treatment. With the patients in whom the pollen test does not become negative, it seems desirable that the patient should have had at least one season and preferably two seasons of complete freedom from hay fever while being treated before treatment should be discontinued.

[The results obtained by Walker are rather encouraging—100 patients cured over wide experience covering many years and, of course, a great many patients. One wonders what the incidence of cures would be in this number of patients if they had received no treatment whatever. All of us see patients who have hay fever for one season, or for several seasons, and then remain practically free perhaps for several seasons. Walker might have given us the incidence of his failures. Take the phenomenon of migraine. These patients have their fluctuations extending over years, sometimes over months where the incidence of headaches are better or worse, or where they entirely disappear, depending on general factors. If some one happens to be doing something for them during the period of improvement, he might claim the credit.—Ed.]

A Few Observations on Asthma. D. W. Myers[2] believes that in asthma cases two things must be done, either one of which may relieve, but both of which will be required for cure: (1) detoxication, and (2) removal of irritation from the ethmoid area.

Ephedrin and epinephrin are useful for only the briefest time and for temporary relief and their use should be discontinued at the earliest possible moment. Indeed they will not be needed after a brief period of rational treatment.

Calcium therapy, light therapy, vaccino-therapy, pollen serum therapy, surgical removal of cervical sympa-

(2) Am. Med., September, 1927.

thetic, allergens, anaphylactics, antigens, etc., *ad libitum* at best offer but temporary relief and are in reality shooting only at the *explosion* and not at the cause.

That asthmatics are all toxic has been definitely proved by Adam, Haseltine, LaForge and others. That all of them have some form of ethmoid irritation is also a well-established fact, and that removal of these factors brings about prompt and permanent relief.

[We find this statement rather extravagantly optimistic. We might be willing to grant that the only nasal conditions which seem to have any relation to the asthmatic phenomena are those conditions which are associated with certain forms of ethmoid trouble, particularly a hyperplastic ethmoid. The only nasal conditions the correction of which is likely to influence asthma are the hyperplastic conditions of the ethmoid. It is quite another matter to assert that operative measures in these cases bring prompt relief. Any one who has knowledge of the anatomy of the ethmoid understands that complete exenteration of the ethmoid is an anatomically impossible surgical feat, and the unsatisfactory results that follow operations on the ethmoid may be dependent on this fact.—Ed.]

Bronchial Asthma with Particular Reference to Nasopharyngeal Pathology. I. S. Kahn[3] states that against nasopharyngeal pathology having any bearing whatsoever on bronchial asthma are several very good arguments.

(1) The heredity of the condition, a definite history of which can be secured in around 80 per cent of the cases. This can be easily overlooked.

(2) The surgery mentioned as relieving asthma does not consist in the removal of any one nerve bearing area or the correction of an identical pathology, but is merely the usual operative procedures for the correction of the same pathological conditions in nonasthmatics.

(3) Wisconsin M. J., September, 1928.

(3) Equally severe intranasal disease or anatomical abnormalities is seen in nonasthmatics.

(4) The various bacterial causes incriminated include all the common types found in the upper respiratory tract, and not any special strain or species.

(5) Climatic and residential environmental changes often give complete relief.

(6) Relief is possible, as has been seen in the presence of frank, obvious uncorrected nasopharyngeal abnormalities and suppuration.

(7) Occasionally in severe prolonged asthma, no nasopharyngeal pathology can be found.

The author sees from 50 to 100 new asthma cases a year, nearly every one of whom has undergone previous nasopharyngeal surgery, ordinarily by highly competent operators, and so far as the consultants he uses can determine, the surgery is usually technically well done and not incomplete. Relief to the asthma has ordinarily been either negative or of only comparatively brief duration. Polyp removal seems the one step giving most consistent temporary relief.

If the results of nasopharyngeal surgery in bronchial asthma were limited merely to inefficacy, this question would not be so important, but actual harm can be done. Without specifically quoting any individual instances, several cases, especially in children, have dated their first asthma to a week or ten days following adenotonsillectomy done to correct nasal obstruction and mouth breathing, where the real etiological hay fever had been overlooked.

Also, in a number of instances in adults, the asthma had been more severe and protracted following surgical nasal measures, and in a few instances where again the hay fever had been overlooked as the real cause of the nasal distress, and sinuses opened, severe chronic incurable suppuration has persisted and actual appreciable harm done.

On the other hand, in favor of nasopharyngeal sur-

gical work in bronchial asthma are several good arguments.

(1) Given a narrowed space between septum and turbinates, any swelling of the mucous membrane, such as occurs in hay fever, would increase this constriction and conceivably produce impingement, irritation, rhinorrhea, sneezing and reflexly asthma, precisely as at times an asthmatic attack can be produced by intranasal instrumental manipulations or nonspecific irritant applications, such as camphor, menthol or eucalyptus oil. Operative work increasing this space should lessen this possibility.

(2) Acute upper respiratory tract infections almost invariably increase allergic respiratory tract symptoms. It is not difficult to demonstrate the fact that allergic sensitivity is increased during the period of such intercurrent infections. It is certainly at least plausible that the elimination of chronic infection should as a corollary, if not eliminate, at least reduce such sensitivity to the point of clinical tolerance and symptom freedom.

(1) Sinusitis and polypi are a little more frequent in asthmatics than in nonasthmatics, judging from such statistics as we now command. The author knows of no comparative statistics regarding spurs and deviations.

Now, a daily or frequently recurring vasomotor rhinitis where swollen edematous mucous membranes mechanically block intranasal drainage, offers in itself a sufficient basis for the institution and maintenance of parasinusitis and polypi. In other words, there exists the possibility not generally considered in these cases, that the nasal infection found in bronchial asthma may often be not primary and a basic cause of the asthma, but actually a subsequent and secondary occurrence. It must be remembered that the chronic asthmatic not infrequently gives a history of past or present definite vasomotor rhinitis, seasonal or otherwise, or a history of nasal discomfort susceptible of such interpretation, such as frequent "colds" and intermittent nasal block-

age. This is especially true if the blockage is not persistently unilateral. Such "colds" are often allergic and not infectious. Surgical work is not only often, in fact usually superfluous in these cases, but if done, even with perfect technic, is attended by the prompt recurrence of infection and polypi unless controlled by subsequent adequate allergic measures. Occasionally, curiously enough, an old chronic asthmatic will admit a hay fever that has disappeared either coincidently with, or subsequent to, the onset of his asthma, of years previous. Then again, as there is no special histological reason for nasal and bronchial mucosa to be simultaneously equally susceptible to an allergic antigen, we occasionally meet with even severe asthmatics in whom no nasal pathology of any description can be discovered.

If there exists such an entity as a specific nasopharyngeal pathology in bronchial asthma, in the author's experience it consists in a mild, often transitory, vasomotor rhinitis. This is the most constant nasal abnormality detected in chronic asthmatics, and when one considers that hay fever is so often a forerunner of asthma, such a finding is not incomprehensible. Typical, severe seasonal hay fever is not common in chronic bronchial asthma. The mildness and evanescent character of this vasomotor rhinitis in these cases is the cause of its being overlooked, and it has been so frequently found in the author's cases only by being intentionally and persistently sought for. Often several examinations of the patient will be required for its detection. It is best found by making the nasal examination during one of the so-called "colds," or after the patient has been in a high wind or on a long country automobile ride in suspected pollen cases, or shortly after prolonged contact with known causal factors in nonpollen cases. A few hours indoor existence, in pollen cases, even the wait of an hour or so in a physician's reception room, may result in its obliteration for the time being. Spraying the nose with extracts of the causal pollens indi-

cated by the history and skin tests will result in its production. Regarding, then, the asthma as merely a pulmonary extension of the vasomotor rhinitis without reference to other nasal pathology present, and handling it on an allergic basis exclusively, will give at least 80 per cent of successful results. Inasmuch as, even in Texas, vasomotor rhinitis is seen at times from feathers and animal hair, there is no reason not to expect this same nasal finding in northern asthma cases of such and other specific etiologies. Every case of asthma that the author has seen originating in Wisconsin has shown this vasomotor rhinitis. In none had hay fever ever previously been diagnosed. In the vast majority of his chronic asthmatics, some handled by the leaders of nasopharyngeal surgery in this country, this vasomotor rhinitis had never been recognized. The explanation is simple. It was not present at the time of the examination or if so, was mild in degree, and lost sight of in the presence or search for more obvious pathology.

Be all that as it may, nasopharyngeal surgery has certainly benefited a certain proportion of asthmatics. Even related cases of allergic manifestations, such as chronic urticaria, have been reported cured by tonsillectomy.

Judging from his own experiences, the author would say that these were cases of allergic sensitivity of low degree that would be symptom free except for the additional load of the sepsis, and correction of the clinical distress could be accomplished by either surgical or allergic measures. In this connection, the severity of clinical symptoms is not a criterion of the degree of sensitivity. Sensitivity to an allergic antigen, such as pollen, may be of a very low degree, requiring massive dosages for symptom production. Such cases, even when comparatively severe in type, often give negative skin tests.

Curiously enough, pollen cases of a high degree of sensitivity are comparatively easy to control by allergic

measures alone without surgery. Our especially difficult cases for desensitization are those of a low degree of sensitivity whose environment brings about symptoms from massive atmospheric pollen overdosage, or in middle aged old chronic exhausted adrenalin users of poor general condition, who seem to have lost all recuperative powers, of whom about three or four a year terminate fatally, and who have almost invariably had previous nasal surgery and decline further surgery.

Nasal surgery, in the author's opinion, in pollen cases offers best prospects in the elimination of mechanical obstruction, and the correction of sepsis in early cases. His experience does not justify conclusions in asthmas of other etiologies. Any condition that would produce cough and expectoration should be at least a mechanical deleterious factor in asthma. Theoretically, the postnasal discharge, bronchitis or bronchiectasis resulting from sinus infection, especially with basal pulmonary radiographic markings, should fulfill this condition. Such cases, in connection with asthma, are either practically very rare as far as influencing the asthma is concerned, or the author is overlooking them.

His experience with surgery in seasonal hay fever cases has been totally unsatisfactory. If coincidental surgery be required in these cases, it should invariably be done far enough ahead to permit of complete surgical healing previous to the etiological pollination season.

[The writer brings out the clinical facts regarding nasopharyngeal conditions and asthma which have long been familiar to the otolaryngologist. It is well to emphasize repeatedly that anatomical irregularities in the nose are conditions, the correction of which does not affect asthma. The vasomotor rhinitis which the author stresses as being associated with asthmatic attacks is one with which every otolaryngologist has long been familiar. A fact not brought out with sufficient clearness is that the sneezing attacks, temporary blocking of the nose, profuse watery nasal discharge, symptoms which are

characteristic of hyperplastic ethmoiditis are not infrequently observed in situations where, because of a high deflection in the nasal septum, a normal ventilation of the ethmoid is impaired and the middle turbinal is placed tightly wedged in between the deflected septum and the outer nasal wall. In just these conditions the correction of the anatomical irregularities producing the obstruction is just as likely to correct nasal symptoms and influence favorably the asthmatic trouble as is the removal of nasal polypi.—Ed.]

Otorhinologic Hygiene of Swimming. H. M. Taylor[4] has gone into the biological side of this question somewhat in detail with the idea of trying to show that man is a terrestrial being and has not the modifications of an aquatic animal. He has not the means of maintaining his body temperature in cold water, neither can he protect his respiratory epithelium from the vitiating effect of water.

The fact that everyone who swims or dives does not contract some ear or nasal infection is no more an argument for the swimming pool than that scarlet fever is not contagious because everyone exposed to it does not have that disease. Neither is it true that the expert swimmer or diver is immune to these infections.

The prevention of aural and paranasal sinus infection should be approached from many angles:

First, chilling of the body surfaces should be avoided, as it lowers resistance and makes the individual more susceptible to organisms normally harbored in the upper air passages or organisms which may be encountered in the water. It is therefore suggested that a time limit of forty-five minutes be placed on the use of a pool by each bather in order that the loss of body heat due to chilling may be minimized. If a person were to wrap a wet blanket about the body and sit in a basement for forty-five minutes he should expect to contract a cold. Yet, the ordinary swimmer does not consider how foolish it is to

(4) South. M. J., March, 1928.

swim for twenty minutes in an indoor swimming pool not exposed to the sunshine and then to lounge around on the cold tile in his wet suit.

The Committee appointed by the Ear, Nose and Throat Section of the American Medical Association to study the otorhinologic hygiene of swimming, feels that persons with wide open nasal passages, straight septums and normal turbinates should not be denied the privilege of swimming, while those with contorted nasal passages, especially if there is a previous history of sinus disease or so-called catarrh and those in whom the turbinates are prone to engorgement or are actually hypertrophic should not be allowed in the water. Individuals with adenoid obstruction, discharging ears or perforated eardrums must not dive or swim. It is suggested that oiled wool or other effective measures of closing the external auditory meatus be advised in order to prevent external otitis.

Proper habits of breathing during the crawl stroke or the dive must be taught, exhalations through the nose whenever the face is submerged and inhalation through the mouth whenever the mouth is out of the water. This should be taught during the first floating lessons before actual diving or swimming takes place.

Such organizations as the Boy Scouts of America, or schools which require a certain amount of swimming and diving, unknowingly jeopardize the health of those members who have physical defects which make them bad swimming risks. Boys are required to undergo these tests before they become Eagle Scouts or make other advances. This committee proposes to take the matter up with the executives of the Boy Scout Movement and hopes to have favorable action so that boys who have sinus infections, chronic discharge of the ears and perforated eardrums shall not be required to undergo diving tests before they are awarded their Eagle Scout Badge. The question of reducing infections of the ears and paranasal sinuses is a matter of educating the public in

regard to it. The responsibility falls not only upon the sanitarians, public health officials, and the otorhinologists; but this is an important phase of preventive medicine to which everyone in medicine, particularly the family physician, should lend his help and support.

Diseases of the Nose

Nasal Accessory Sinuses

Cytologic Examination in the Diagnosis of Infection in the Nasal Accessory Sinuses. Applied to the antrum E. C. Sewall's[5] method is as follows: The nose is cocainized underneath the inferior turbinate. A sterile No. 16 needle, without handle or obturator, is introduced into the antrum in the usual manner. Care is taken not to pass the needle against the opposite antral wall because it may cause bleeding. Blood, while confusing, is rarely encountered and can be distinguished under the microscope. When the needle is in place a 5 c. c. Luer syringe is connected directly and the piston is withdrawn. If fluid appears, it is placed in a sterile tube for examination. If, however, air is drawn freely into the syringe one may know that the point of the needle is free in the antrum and that the opening into the nose is patulous.

Twenty c. c. of sterile water or isotonic solution is warmed in a small 40 c. c. Florence flask. The 40 c. c. size will admit the barrel of a 5 c. c. Luer syringe. The head of the patient is bent well over toward the corresponding side, in the position best favoring retention of the fluid in the antrum. The syringe is connected again and the warm solution is injected slowly into the antrum. The patient is asked to tell if the solution is felt to go down the throat. After 5 or 10 c. c., more or less, according to the free available space in the antrum, have been injected, the piston is slowly withdrawn and the recovered fluid is placed in a sterile test tube for exami-

(5) Ann. Otol., Rhin. & Laryng., June, 1928.

nation. Both sides are usually studied, where necessary, at the same time, a separate flask of solution and another syringe, of course, being used.

Where the fluid returned is contaminated sufficiently, a slide may be made directly from it. However, where there is little or no evidence in the returned solution, it is put into a centrifuge and a slide made from whatever may be deposited at the point of the centrifuge tube.

Normal antra show no cellular content whatever; low grade infection is productive of mononuclear leucocytes; while the more active processes furnish either polymorphonuclear leucocytes alone, or polymorphonuclear mixed with mononuclear cells. Or in the same antrum one may find pus lying on the floor containing only the polymorphonuclear type of cell, while above the pus the cavity of the antrum may furnish a preponderance of round cells in the injected and aspirated fluid.

This method has shown that many antra are diseased that formerly were considered normal. Many interesting facts have been elicited that have given new ideas as to diseased antra. Where the antra have been operated upon, the mucous membrane is examined histologically, and this check has been invaluable in estimating pathology. The *x*-ray is of the greatest aid in diagnosis. Except in the cystic variety one rarely finds true mucous membrane thickening without finding the explanation for it in the cytologic study.

Cystic degeneration of the mucous membrane is an interesting pathologic condition. The cyst may fill the antrum completely and, if so, the needle introduced taps the fluid and it runs out freely like fluid from an ascitic abdomen. Cysts of large size are often shown in the *x*-ray plates, rising up free in the antrum. It has been possible to pass the needle into the antrum missing the cyst. Injection and withdrawal of the solution has shown accompanying disease when present.

Then the needle has been made to engage the cyst, rupture it, returning the typical yellow fluid characteristic of cyst content. The author has introduced the needle into the antrum, withdrawn the piston, getting nothing but air. Then, on filling the antrum with solution and withdrawing again, has gotten thick, yellow mucopus in quantity. The needle evidently passed above the level of the pus.

It is also common to find it impossible to withdraw the piston after connecting with the needle. This is due to one of three things: (1) The needle has become stopped up. If that is the case the sterile wire obturator is passed through the needle, removing the obstruction; (2) the point of the needle is engaged in thickened mucous membrane or possibly thick, inspissated discharge. It may be freed in some cases by moving the point of the needle about until an open space is found. In some instances the antrum may be so filled up with polypoid tissue or thickened secretion that no aspiration is possible. In such cases the *x*-ray will show the antrum entirely opaque, although it may not be able to distinguish in such opacity between mucous membrane thickening and fluid. (3) The opening into the nose has become stopped up from thickening of the mucous membrane in the sinus or in the nose. Sometimes there is a valvelike action which permits air or fluid to pass in one direction but not in the other.

[The author is to be complimented on the careful orderly fashion in which he goes about to make an examination of the antrum. The question which comes up in connection with the recognition of latent forms of sinusitis, that is, where no pathological secretion is demonstrated except by centrifuging the washings, is "What clinical significance does such data afford?" Certainly such a sinus is not any local annoyance to a patient. Has it any more significance than the ordinary forms of chronic rhinitis associated usually with patho-

logical secretions in the nasal passages or in the post-nasal space so commonly observed in adults? Does the recognition of a polypoid degeneration of the mucosa of the sinus which is not causing any local annoyance, have any more significance than the hyperplasia so commonly observed in the membranes lining the nasal passages? In the latter the chief indication for operative interference is because of obstruction to nasal respiration. In the antrum this is not a possible indication. Providing ample ventilation and drainage through a window resection in the antrum wall would take us as far in the treatment of such conditions in the antrum as the rhinologist feels justified in applying to the nasal passages. Is it any more reasonable to assume that the patient is better off for an exenteration of these thickened membranes in the antrum than he would be to have the membranes lining the nasal passages curetted away? —Ed.]

Cerebrospinal Rhinorrhea Following Intranasal Surgery. Eight cases reviewed by E. H. Campbell[6] are illustrative of the rare complication of cerebrospinal rhinorrhea following intranasal operations. Three died from a cephalomeningitis and five survived with cessation of the discharge. Three cases followed ethmoidectomy, one spheno-ethmoidectomy, one the removal of polyps and the middle turbinate, one the treatment of a sinus infection, and one the rasping of a frontal sinus.

The author's case illustrates a rare and serious complication following operation on the ethmoid sinuses. It was expected that the condition would promptly terminate in a meningitis, but no untoward symptoms whatever followed the operation. It would have been interesting and instructive to have thoroughly examined the right ethmoid region while the fluid was dripping to determine the exact conditions present, but this would have meant the cleansing of the blood clots

(6) Ann. Otol., Rhin. & Laryng., September, 1928.

and other material from around the operated area. It was thought better to avoid any intranasal manipulation because of the fear of carrying infection into the meninges, and to let the fluid drain as much as possible in order to carry infected material away from the meninges. The drainage was therefore encouraged by putting the patient on a forced liquid intake and keeping her head low.

Speculation as to the cause of the escape of this fluid leads one to the opinion that in curetting the ethmoid cells a spicule of bone attached to the dura might have been torn away, leaving a small opening in the dura, or there may have been a necrotic process of the bony structure in the deeper ethmoid cells that caused a breaking down of the wall protecting the dura and a partial or complete destruction of the underlying meninges. The fact that this patient recovered, as did also several others of a similar kind reported in the literature, gives one the impression that this complication may not be as serious as is commonly believed.

There is no established treatment for this condition. Practically all authors are agreed that all intranasal manipulation should be strictly avoided. There have been tried adrenalin subcutaneously, atropin internally, sodium iodid internally, thyroid extract and benzyl benzoate, but none of them seem to cause any reduction in the amount of flow from the nose. Restriction of liquids and repeated lumbar puncture will decrease the flow of fluid and is probably indicated in the types of cases accompanied or caused by increased intracranial pressure. However, in postoperative cases it seems questionable whether any attempt should be made to lessen the flow because the constant passing of the fluid over the injured area will tend to wash any infected material away from the meninges while the reparative process is going on. So long as there is not an increased intracranial pressure it is unlikely that the subarachnoid fluid would be sufficient in pressure

to prevent the closure of the perforation through the dura.

[The fact that the intranasal operations, ethmoid, frontal, etc., have resulted in fracture through the base of the skull is an evidence that measures entirely too radical are frequently undertaken for the relief of such conditions as an ethmoiditis. The uncapping of the ethmoid taking away the floor allows drainage of secretion from the ethmoid cells and accomplishes exactly as much where one attempts to take out the trabeculae as far up as the plate of bone forming the floor of the brain cavity. Entirely too much emphasis has been put upon the so-called complete exenteration of the ethmoid. Any one who knows the anatomy of the ethmoid knows that complete exenteration is a physical impossibility in almost all instances due to anatomical conditions. Too many operators are hipped with the idea that the more radical procedure the better the operation is the case in regard to the nasal sinuses. A pretty good rule would be to ask the operator whether he would care to have such a radical manipulation carried out on his own nose. Surgeons are justified sometimes in taking desperate risks, but such risks are only taken in desperate cases. The ordinary sinusitis for which intranasal operations are called for does not constitute the menace which justifies unusual risk in operating. "Let the punishment fit the crime" is a useful proverb which might be applied to intranasal surgery.—Ed.]

The Paranasal Sinuses as Sources of Infection. From his experience V. V. Wood[7] comes to the following conclusions:

1. Absorption and dissemination of bacteria by the circulation directly from the nasal sinus mucosa in large enough dosage to produce secondary infection is not a frequent occurrence.

2. Absorption and dissemination of toxins directly

(7) Ann. Otol., Rhin. & Laryng., June, 1928.

from the nasal sinuses in large enough dosage to produce symptoms is a much more frequent occurrence.

3. The production of severe constitutional reaction and symptoms by either acute, subacute or chronic uncomplicated nasal sinusitis is rare.

4. Blood borne secondary foci of infection produced by nasal sinusitis, result from the pus leaving the sinuses through their natural orifices; descending by gravity or aspiration over other structures of the respiratory tract, such as tonsils, extratonsillar lymphoid tissue on the pharyngeal walls, trachea or bronchi, and secondarily infecting these structures through contact; thence fed by them into the circulation.

5. It is possible that dissemination of infection through the circulation directly from the paranasal sinuses does occasionally occur, probably due to a rare combination of virulent organisms helping liberate each other from localization for extension and spread or else due to abnormally thin walled cells, dehiscences or traumatic breaks in the normal sinus walls.

6. Focal infection with primary foci in nasal sinuses is more frequent in the young than in the adult and is a different problem altogether in such subjects.

7. The lack of great absorption from the nasal sinuses is probably due to the anatomical fact that the sinus mucosa is not vascular and further to the rarity of complete blocking of sinus drainage with subsequent intrasinus pressure.

8. There is some vague heretofore unexplained connection between certain eye lesions and the nasal sinuses. However, it seems to be equally definitely established that focal infection is not the true etiologic explanation in many of these conditions.

[That systemic infection may follow upon a pharyngitis or an ordinary head cold, an acute rhinitis, is clinically well recognized. That an extension of the inflammation to the membranes lining the sinuses brings with it any greater likelihood of systemic infection than

does the involvement of the nasal pharyngeal mucosa is, I think, a debatable question.—Ed.]

The Influence of Paranasal Sinus Infections in Infants and Young Children Upon Certain Systemic Conditions and the Influence of Certain Systemic Conditions in Infants and Young Children Upon the Method of Treating Coexisting Sinusitis. According to L. W. Dean[8] the opinion of the pediatrist as to the probable presence of infection of the sinuses, in the ears, or both is most important. The decision as to whether or not to attack the sinuses energetically, and if they are to be attacked, the time when it should be done is best made by the pediatrist.

No rules that are infallible for the treatment of paranasal sinus disease with systemic complications can be cited. Each case must be studied by the pediatrist and the laryngologist together, and the "clinical sense" of the two will decide what the treatment is to be. The systemic conditions associated with paranasal sinus disease in infants and young children influence the choice of treatment. Each condition exerts its own influence. They may indicate the need of immediate drainage of the maxillary sinuses, as in a very severe case with the cholera infantum syndrome.

They may indicate the necessity of avoiding traumatism of the mucous membrane, as in nephrosis and in diabetes except under insulin control. They may indicate the need of radical procedures to remove the last vestige of paranasal sinus infection, as in arthritis, chorea and asthma. They may indicate the need of several re-examinations of the sinuses in the more chronic systemic conditions and the treatment of the disease which is usually found on careful search.

[The proper handling of the exceptional cases where the sinuses in children are involved is quite a different problem than that of taking care of sinus disease in adults. The difficulties of carrying out without undue

(8) Ann. Otol., Rhin. & Laryng., December, 1927.

traumatism any except the simplest measures, makes the indication for operative treatment extremely exceptional in children.—Ed.]

Displacement Irrigation of the Nasal Sinuses with Suction. D. W. Layman[9] is very enthusiastic about this procedure and finds it successful in acute, subacute and chronic infections. The author uses the technic of Proetz, and just previous to the irrigation with suction he shrinks the mucous membrane of the ostia with ephedrin-cocain solution in hypertonic solution.

The irrigation with suction is either performed with hypertonic solution or an antiseptic solution. Also the former can be followed in four to twenty-four hours by the latter. As regards antiseptic solutions, the author has used collene 25 to 50 per cent., neo-silvol 10 to 15 per cent., and metaphen 1 to 5,000. Mercurochrome proved to be too irritating and so was discontinued.

Complications following the displacement irrigation with suction: The author had two cases of fullness in the ears, with temporary impairment of hearing; in one the condition lasted a few minutes, and in the other it continued for several hours. There was one case of ear ache, caused by a fit of coughing and clearing of the throat when an overflow passed into the pharynx; in this case there was probably too much pressure used with the suction bulb; after several hours the ear ache subsided. The patient was treated subsequently with displacement irrigation and no disturbance followed. There were several cases of sneezing, coryza, and moderate frontal and eye pain after the use of some of the antiseptics, especially Arbuckle's solution; but these symptoms disappeared after several hours. In a unilateral sinusitis there is a possibility of carrying the infection into the other nasal cavity, as a result of using an excess of fluid or too much pressure; this

(9) J. Indiana M. A., February, 1928.

happened to one patient, but caused only a rhinitis which cleared up in a few days.

Diagnostic possibilities: Radiograms of the posterior sinuses, after displacement treatment with iodized oil, (lipiodol diluted one-half with olive oil) show the cells clearly outlined. Those sinuses with marked pathology and the hyperplastic type will not fill. The writer recommends a trial of the displacement treatment with oil, as a procedure that may be of some aid in the diagnosis of suspected sinus disease where the usual radiograms or clinical symptoms have failed to make a definite diagnosis.

It may come about in the future that nasal hygiene will be observed by rhinologists as a regular procedure in cases of rhinosinusitis during the latent or quiescent period; just as dental and oral hygiene is carefully observed by dentists. To carry out the nasal hygiene treatment, rhinologists should give the displacement irrigation with suction a trial. The timely use of this procedure in the acute and recurrent cases, and followed by nasal antiseptics, will in a number of cases prevent the subacute and chronic nasal sinus diseases from developing. Even many of the latter have been benefited materially but it is too soon to claim any cures.

Sources of Error in Sinus Radiography with Fluid Contrast Media. According to A. W. Proetz[1] most errors in sinus diagnosis by means of fluid contrast media are the result of unfamiliarity or inexperience with the method and are not due to any shortcomings of the method itself. Certain simple precautions should be followed, such as are observed in inspecting fluids in any other translucent containers.

Partial filling and the horizontal beam have proven most satisfactory in the author's hands. (Figs. 49 and 49A.)

Adventitious causes of error should be avoided, such as washing immediately before oil injection.

(1) Ann. Otol., Rhin. & Laryng., September, 1928.

Standard positions should be accurately adhered to in order to familiarize oneself thoroughly with the con-

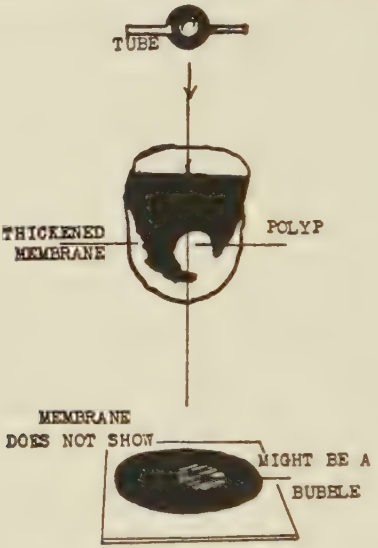

Figure 49.

Figure 49A.

tours of the complex sinus-shadows. Precision apparatus has been designed for this purpose.

The Ethmoid Problem. Experience has taught R. H. Skillern[2] that aeration and drainage are as essen-

(2) Ann. Otol., Rhin. & Laryng., March, 1928.

tial to the ethmoid mucosa, in order to rid itself of infection, as oxygen is to the lungs, and of the two aeration is far the more important. If there is good aeration the drainage will take care of itself. What prevents the inspired air from freely circulating around, over and through the cells of this diseased and inflamed labyrinth? First, the body of the middle turbinate, and second, the swollen and ofttimes polypoid mucosa. The indications to bring around this desired aeration is to remove the obstruction thereto, namely, the middle turbinate. Skillern disagrees with some of his friends, who consider this structure of great physiologic moment in nasal respiration and who make every effort to preserve it intact by performing an excavation of the cells between it and the orbital plate. He cannot agree with them in this respect, nor can he subscribe to the importance of all the functions which they attribute to it.

It seems to the author, if one accepts that aeration is the primum desideratum in the ultimate cure, that to keep the middle turbinate in place defeats the very object of the intent, for this body acts as a barrier in directing the inspired air with its high oxygen content from and away from the posterior ethmoid regions. The middle turbinate is then removed in its entirety by the method most favored by the individual operator. Personally he prefers the scissors and snare, removing as much as possible with the first constriction of the wire and leaving permanently the posterior end to about the size of a small pea. He has found by leaving this portion that hemorrhage, both immediate and post-operative, has become a thing of the past. This is due to the fact that the large nasopalatine artery branches lie just behind this point, so that by avoiding the extreme posterior end of the turbinate injury to this artery is also avoided. The removal is made on a line with its insertion into the ethmoid body proper, thus keeping well below the terminal fibrils of the

olfactory nerves and avoiding the possibilities of the dangers incurred in opening their perineural sheaths, which, of course, lead directly into the subarachnoid space.

As soon as this turbinate is removed, the operative technic should be suspended, except perhaps for the removal of ragged portions of bone or mucosa which happen to remain. The main point is to leave the body of the ethmoid absolutely intact. Enthusiasm in this regard may be the very cause of doing wrong as the author has found that to continue at this stage is to distinctly overdo it, for in endeavoring to remove this redundancy of hyperplastic tissue one not only takes it, but also a certain amount of healthy tissue in the immediate vicinity, both of which would have in all likelihood returned to normal following the aeration made possible through the removal of the turbinate. So that the one endeavor is to completely and cleanly resect this structure and discontinue any further surgical manipulations, at least for the time being.

About five days, then, after the removal of the turbinate, on inspection, the whole ethmoid capsule on that side has undergone a marked change. Instead of a mass of acutely infected, swollen and hypertrophied tissue, the entire picture has changed, giving one the impression that the inflammation has not only markedly lessened, but also shows a tendency to congregate in certain places, with areas of mucosa intervening which apparently have entirely regenerated, especially if marked hyperplasia had been uncovered when the turbinate was first removed. Even small solitary polypi have reduced themselves almost to disappearance. At this time is the proper moment to use the method for the purpose of ascertaining the spread of the infection. This can be done by applying some substance which will not only tend to draw the inflammatory products out of the infected tissues, but also to act as a germicide as well as have a beneficial, curative action on the

diseased mucosa. The author feels convinced that he has found a true panacea in tampons about the size of one's thumb saturated with a strong solution of colloidal silver. Many firms manufacture such a drug, which goes under the name of argyrol, silvol, cargentos, silloid, etc.; all are claimed to be nonirritating. There are, however, several conditions in their application which must be observed: First, the solution must be strong (25 to 50 per cent); second, the solution must be fresh; third, the solution should be hot or at least warm; fourth, the tampons must remain in place from four to six hours. These tampons while in place act in a similar manner to a hot poultice, but in a two-fold manner. First, they tend to draw the inflammation toward the surface, and second, have a decided bactericidal action on the infecting microorganism as well as possessing a healing quality beneficial to mucous surfaces.

In cases where the ethmoidal labyrinth has been previously operated the author removes the uncinate process and proceeds with the tampon treatment as outlined.

[The author's experience has led him to a conclusion that the production of symptoms from the ethmoid is the result, often with conditions which impair the normal ventilation and drainage. A high deflection of the septum crowding the middle turbinal body against the outer nasal wall creates this condition exactly as does a hyperplastic ethmoid with polyp formations. In both situations the surgical correction consists of the establishing of proper ventilation and drainage. This may require the correction of the deflected septum in addition to the resection of part of the concha media. Where polyps are a conspicuous finding the simple procedure of uncapping the ethmoid by the removal of the floor with properly constructed biting forceps should be the operation of choice. It is the simplest carried out of any operation on the ethmoid and can be made just as thorough as the situation calls for. As the author points

out, the trouble too often is indulging in excessive operative measures rather than too little.—Ed.]

Various Factors Concerning the Frontal Sinus. In view of the fact that acute infections of the nasal accessory sinuses have a tendency toward spontaneous healing, W. Mithoefer[3] believes that treatment in these cases should be conservative. When the frontal sinus is involved the best application is a tampon of 5 or 10 per cent cocain. Adrenalin or suction should not be used because of the subsequent reaction. No cannula should be passed along the naso-frontal duct for the purpose of irrigation. The remaining treatment consists of rest in bed, light therapy, menthol inhalations, and aspirin and codein. In real severe acute infections the author favors a small external opening in the orbital wall of the frontal, rather than operating intranasally.

In regard to chronic frontal sinus infection all the intranasal measures should be carried out before resorting to the external route. While admitting the failures that frequently follow the radical external operations, nevertheless the writer believes that in properly selected cases these operations are indicated. In some instances a discharge continues, but its character is changed and the patient improves in health. The radical operation is mostly indicated in cases where severe headaches are complained of and where intranasal procedures have failed. When purulent discharge alone is noticed, the operation is not urged. It is also a fact that the proper handling of the anterior ethmoids either intranasally or along with the external operation, is the keynote to the successful result of the frontal sinus.

Causes of post-operative retention are as follows: (1) failure to remove all diseased mucous membrane from the frontal; (2) incomplete removal of all diseased ethmoid cells; (3) failure to remove the lacrymal bone and the greater part of the nasal process of the superior maxilla; (4) insufficient removal of the crista

(3) J. Med., February, 1928.

frontalis when it forms a part of the floor; (5) the development of an osteitis, especially with the formation of excessive granulations and scar tissue; (6) the prolapse of orbital tissue into the nose because of too radical removal of the lamina papyracea; (7) too much after-treatment which causes the formation of excessive granulations; and (8) the removal of too much of the mucous membrane of the posterior wall of the naso-frontal duct.

In the author's operation the incision is made from just medial to the supra-orbital notch downward to a point opposite the lower orbital ridge. The soft orbital tissue is carefully dissected away and the frontal sinus opened by chiselling on the orbital floor. The nasal process of the superior maxilla, part of the nasal bone, and the lacrimal bone are removed with the Hajek maxillary punch. The ethmoids are removed with biting forceps, and the sphenoid may also be inspected. An important feature of the operation is the mucous flap which covers the region of the crista frontalis and prevents granulations from closing the sinus outlet. The mucous membrane is obtained from that preserved in the nose at the time of operation; or else it is taken from the lower lip. No packing of the sinus is done, and the wound is closed with silk sutures.

The author has performed 75 operations. Four cases had post-operative osteomyelitis, and ten required opening the second time.

Brain Abscess (Frontal Lobe) Complicating Frontal Sinusitis. In this article C. J. Imperatori[4] reports on five cases.

Age.—All of these patients were under twenty-eight years of age and in these five cases, two were young girls. In Case I, the patient was twenty-seven years of age; in Case II, fourteen years; in Case III, fifteen years; in Case IV, twenty-one years, and in Case V, twenty-five years of age.

(4) M. J. & Record, Oct. 5, 1927.

Operations.—All had fronto-ethmoiditis with either an abscess of the orbit, a chemosis or edema of the upper lid. In Cases I, II, III, and V, the patients had external fronto-ethmoid operations done at the onset. In Case IV an intranasal operation had been done four days before the external.

Apparent method of invasion of the cerebrum.—In Cases I and IV invasion was by direct extension from the frontal sinus with osteomyelitis; in Case II, by a metastatic infection; in Case III, by direct extension; in Case V, by direct extension, although a fistulous tract was not demonstrated.

Location of lesions.—In Case I, anterior part of the right frontal lobe; in Case II, on side opposite the frontal sinusitis and in the region of the cribriform plate, that is, rightsided; in Case III, on the side originally searched no abscess was found but in the region of the cribriform plate in the right frontal lobe, the abscess was found; in Case IV, epidural abscess in midparietal area was first located and later a cerebral abscess was located in the posterior part of the frontal lobe on the side of the frontal sinusitis, that is, rightsided; in Case V, in the region of the cribriform plate on the side of the frontal sinusitis, that is, leftsided.

A summary would therefore be, four rightsided abscesses and one leftsided. In three of the rightsided ones the patients had convulsions at some time prior to the evacuation of the abscess. The fifth patient had a temporary aphasia and a pronounced optic atrophy. All the others had slight eye-ground changes. This last patient had decidedly a changed temperament, the other apparently did not.

Bacteriology. Staphylococcus aureus occurred in all five cases.

Blood picture.—Leucocytosis was always above 15,000 and polynucleosis of 80 plus.

Prominent symptoms.—(1) Headache, especially at night and located on the side in which the abscess was

found. (2) Occasional vomiting. (3) Chemosis and some eye-ground changes. Optic neuritis when the abscess is localized. (4) High temperature toward morning. (5) Pulse rate usually in relation to the temperature and in no case was it noted to be low. (6) Insomnia, some mental dullness and poor memory dependent on the progress of the brain destruction. (7) Convulsions. (8) Tactico-optical aphasia. (9) Diminished abdominal reflexes, contralateral to the lesion. (10) Exaggerated knee jerks and ankle clonus usually demonstrated.

Result of evacuation of abscess.—In Case I, patient alive two years after operation; lost trace of. In Case II, patient alive and well. In Case III, patient lived fourteen months after operation. In Case IV, patient died thirty-six hours after operation. In Case V, patient died within a week.

Gross and Microscopic Pathology in Twenty-three Consecutive External Frontal Ethmosphenoid Operations. In the twenty-three cases reported, W. L. Simpson and R. Harris[5] found two cysts, one osteoma, no cholesteatoma; twelve were polypoid, there was bony necrosis to the point of perforation in three, periostitis in twenty, one granuloma, no mucous membrane tumor, and one case had no partition between the two frontal sinuses.

Polypoid degeneration of the lining of the frontal sinus may take place first and principally at the outer angle in large frontal sinuses, and also about and above the natural opening in any sized cavity. The use of pharyngeal mirrors has been of much service in the removal of small tags of soft tissue from the frontal sinus; especially was this true in high, narrow cavities where direct vision was impossible. In a general way the diagnosis in these cases was confirmed by the operative and histologic findings. There was ulceration of the mucous surface in several cases as was demonstrated by the microphotographs. Metaplasia of the mucous

(5) Ann. Otol., Rhin. & Laryng., June, 1928.

membrane was present in a good percentage of the twenty-three cases reported. Goblet cell hyperplasia was particularly marked in one case and this was associated with subperiosteal hemorrhage.

Prolonged chronic irritation of the mucous membrane was apparently responsible for metaplasia changes. Hyaline degeneration of the basement membrane was present in several cases. In the submucosa in nearly every case there were present many thrombotic blood vessels, blood vessels with hyperplastic walls, some hyaline degeneration of the blood vessel walls, dilated lymph channels, and atrophic and dilated mucous glands. The submucosa was hyperplastic in all cases and contained polymorphonuclear cells, plasma cells, fibroblasts, small round cells, eosinophiles and eosinophilic myelocytes varying in the several cases. The periosteum was markedly thickened in every case. In some cases it was ten or fifteen times thicker than normal. Subperiosteal hemorrhage was present in at least one case. In the bone, resorption with widening of the Haversian canals and marrow spaces, together with roughening of the edges of the bony walls, were common findings. There was lymph channel dilatation in the bone marrow in at least two cases. Blood vessel thrombosis with obliteration of the vessel lumen in the marrow spaces and also in the submucosa was present in several cases of acute osteomyelitis. In one instance there was obliteration of a vessel and partial organization of the clot suggesting one method of total occlusion of the blood vessels. There was hyperplasia of the bone in several cases and exostosis demonstrable in at least one case.

Disturbance of the Optic Nerve Caused by Malignant Disease of the Sphenoid. Malignant disease of the sphenoid has been found twice in 125 patients by L. E. White[6] but probably occurs much more rarely than this would indicate. It was associated with gradual unilateral loss of vision. There was little general inca-

(6) Arch. Otolaryng., October, 1927.

pacity or pain until within a month or six weeks of the end. A central scotoma for color was found in one case, and temporal vision was better than nasal in the other. There was apparently no special pituitary disturbance, pallor of the optic nerves or hemianopsia. Early roentgenograms were negative, while later ones showed destruction of the sphenoid. Optic atrophy apparently did not occur in either case.

The bony barrier between the brain and the nose was gradually broken down by the malignant growth, so that bacteria eventually gained access to the meninges and thus terminated the patient's suffering.

In cases of suspected malignant involvement of the sphenoid, frequent roentgenograms of the posterior sinuses, sella and optic canals should furnish valuable diagnostic data. Tissue for microscopic study should always be saved when the posterior sinuses are opened. It is doubtful, however, whether a diagnosis could be made early enough in any case to justify any more radical surgical procedure than the use of large doses of platinum screened radium after the removal of the front wall of the sphenoid and as much of the growth as could be reached without injury to the adjacent structures.

Retrobulbar Neuritis and Infection of the Accessory Nasal Sinuses. In this interesting article K. S. Oliver and S. J. Crowe[7] present numerous charts of visual fields before and after operation, and present microphotographs of the mucous membrane of the walls of the sphenoid and posterior ethmoidal sinuses, showing the types of pathology met with in these cases (Figs. 50 and 51).

Ten cases are reported, all of which are examples of retrobulbar neuritis developing as a result of infection in the accessory nasal sinuses. In each of these cases, however, the patient was admitted to the hospital and was subjected to a thorough diagnostic study in order

(7) Arch. Otolar[illegible]g., December, 1927.

to eliminate the other common causes of retrobulbar neuritis, and to search for foci of infection in the teeth, tonsils, genito-urinary tract, appendix, gallbladder and large intestine.

Fig. 50.—(case 3) Appearance of mucous membrane removed from posterior ethmoidal cells. This infection dated from scarlet fever three months previously. Vision was 4/200 before operation, and was normal on the ninth day after operation.

In this selected group of cases, an infection in the upper respiratory passages was the only apparent cause for the lesion in the eyes, and in the majority of instances operative procedures on the infected sinuses resulted in normal vision. In several cases the nerve had already undergone permanent changes, so that no improvement followed operation.

Ocular Involvement in Sinus Diseases. Summarizing

his present study E. S. Thomson[8] states that: (1) Sinus diseases cause iritis, cyclitis, retinitis, and choroiditis, in almost as great frequency as they cause optic neuritis. (2) The diagnosis of the causal relationship is so difficult for the rhinologist, in many cases, that it must remain

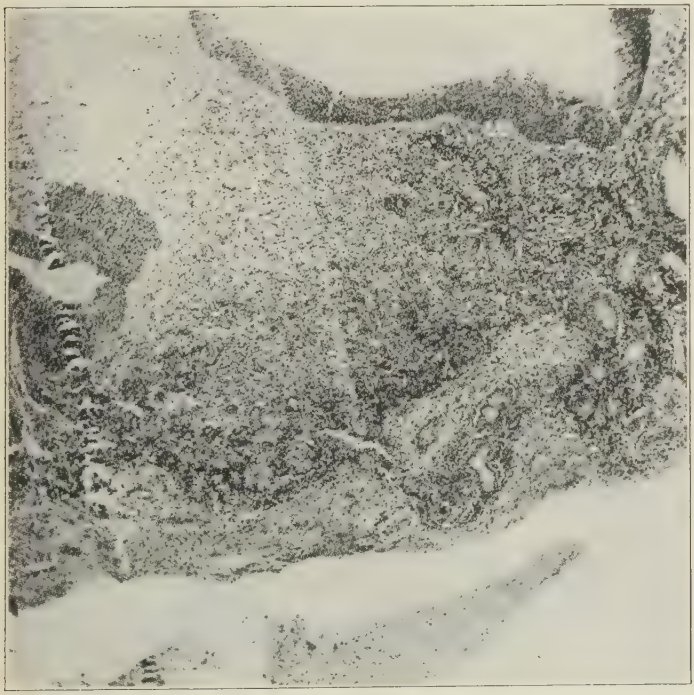

Fig. 51.—(case 4) Appearance of mucous membrane from a posterior ethmoidal cell that was located above the right sphenoidal sinus. This cell was overlooked at the first two operations, and it is noteworthy that the visual disturbance did not clear up until this cell was located and drained.

for the ophthalmologist to decide when the sinus operation should be done. (3) Time is of the greatest importance, as destructive changes in the ocular tissues often take place with great rapidity. (4) Certain clinical pic-

(8) Laryngoscope, August, 1928.

tures in the eye are almost diagnostic of sinus disease and others are so suggestive that, taken in connection with the absence of other causes, a diagnosis of strong probability can usually be made. (5) The dangers of a correctly done sinus operation are not sufficient to justify a temporizing course where the integrity of the eye is endangered. (6) The closest co-operation is essential between the ophthalmologist and a rhinologist of proved technical ability to secure the best results. (7) In the vast majority of cases, if treatment can be promptly instituted, the results of operation are excellent—in many cases remarkable. (8) Even in late cases, where a reasonably positive diagnosis can be made, operation should be done, as the results are often surprisingly good.

[The author's statement, "The diagnosis of the causal relationship is so difficult for the rhinologist, in many cases, that it must remain for the ophthalmologist to decide when the sinus operation should be done," is a little uncertain of interpretation. If he means to imply that in a case with a diagnosable sinus infection the ophthalmologist may be the one best fitted to determine when an operation should be done, we would gladly concur. If he means to infer that where a sinus disease is not diagnosed the ophthalmologist is the one to demand an operation, we find it a little difficult to follow him. As a matter of fact, any sinus disease capable of producing ocular involvement should present no particular difficulty to a trained rhinologist and a careful observer in making the diagnosis. To proceed on the assumption that an optic nerve involvement which follows, shall we say, an acute rhinitis justifies the conclusion that some sinus is involved in spite of negative findings by a careful competent rhinologist is to our minds an entirely wrong premise. The fact that, as the author states, an early operation in these cases will frequently lead to recovery is no justification for the conclusion that these early operations, in the absence of

definite pathological findings in the sinuses, had anything whatever to do with the recovery. Such cases would have recovered just as readily without the needless operation upon the normal sinus.—Ed.]

A Group of Sinus Cases Presenting Interesting Cranial Symptoms. In reporting ten cases of this nature E. A. Looper[9] states that the accessory nasal sinuses are anatomically so closely related to important areas of the brain, that it is not unusual to have severe cerebral manifestations develop from apparently trivial nasal infections.

There is a very intimate anastomosis between the blood supply of the sinuses and the cranial structures so that a small amount of toxin from a low grade sinus infection is sufficient to produce alarming mental symptoms if carried to some vital center. Most of these patients have been sent into the hospital with suspected intracranial lesions, new growths or organic mental disturbances. But the most thorough examination failed to reveal any other cause for the trouble except a sinus infection. Most of the cases cleared up after a simple antral puncture and drainage.

The most probable explanation would seem to be a cerebral edema due to reaction of toxins, carried directly to the brain by the close relationship of the vascular anastomosis. It also demonstrates the importance of making careful routine nasal examinations in all medical cases, and particularly in suspected cases of encephalitis, brain tumors, epilepsy or unusual cerebral manifestations.

Fractures of the Facial Bones Involving the Nasal Accessory Sinuses. In view of the number of cases coming to him, J. B. Naftzger[1] became interested in this subject and produced experimental fractures on the cadaver. Hence he was able to study from both a clinical

(9) Ann. Otol., Rhin. & Laryng., June, 1928.
(1) Ibid.

and experimental standpoint the extent and complications of these fractures.

In the first examination of a case careful inspection is important. This inspection must include the contour of the face, the alignment of the teeth, the infraorbital ridge, the malar bones and the zygomatic processes. If the teeth drop downward on opening the mouth the examiner must determine whether there is a transverse fracture with separation from the skull or a fracture involving the alveolus and the palatine processes only. There are usually multiple lacerations of the soft tissue and openings may extend through the comminuted bones in the antrum, ethmoid or nasal cavities and in some instances into the frontal sinuses. There is usually

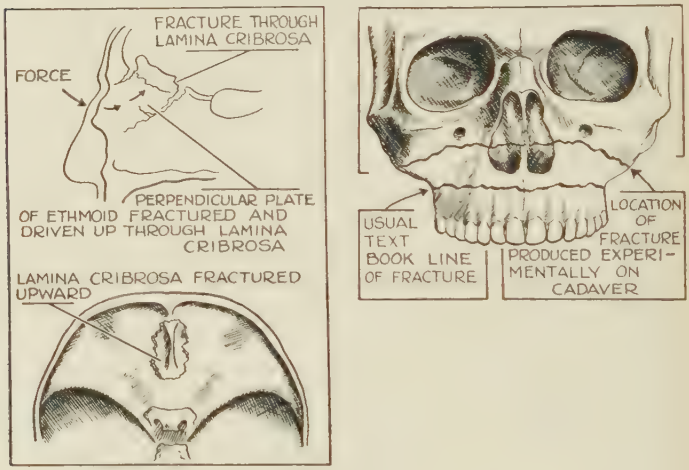
FRACTURE THROUGH LAMINA CRIBROSA
FORCE
PERPENDICULAR PLATE OF ETHMOID FRACTURED AND DRIVEN UP THROUGH LAMINA CRIBROSA
LAMINA CRIBROSA FRACTURED UPWARD
USUAL TEXT BOOK LINE OF FRACTURE
LOCATION OF FRACTURE PRODUCED EXPERIMENTALLY ON CADAVER

Figure 52.

considerable edema which changes the contour over the normal bone and obscures the fracture, thus adding difficulty to the diagnosis. By digital palpation crepitus can usually be elicited in these fractures. If the case is not seen until several days following the injury and there is continuous pain and considerable swelling over

the antrum and side of the face it usually indicates a fracture. A radiogram is of value if properly taken but unfortunately in many of these cases it is impossible to get a satisfactory radiogram due to the extensive injury and the condition of the patient (Fig. 52).

Lacerations, if extensive, must be sutured, but sutured loosely to provide drainage, particularly if the tissues are much mutilated. Where the edge of the laceration is very ragged it is better to trim off the loose tissue before suturing. The facial tissues have apparently a greater immunity to infection than do other tissues, due to the abundant blood supply, so that the end results are more gratifying than would at first seem possible. It may be necessary to put in a small drain such as silkworm if the laceration is extensive and extends into the nasal cavity or sinuses. The eyelids demand especially careful approximation.

The bony fractures are the most important and demand immediate attention. Early reduction and immobilization of the fractured parts reduces shock, relieves pain, controls hemorrhage and gives a more rapid restoration of function. A dental surgeon is indispensable if the alveolar processes and teeth are involved, or if there is a transverse fracture of the superior maxilla with separation from the skull. The dental or oral surgeon is much more familiar with the making of the splints and appliances necessary to reduce and hold these fractures. The fractures mentioned are as a rule multiple, often comminuted and frequently compound. Where the alveolus only is fractured the dental or oral surgeon can apply interdental wiring where the patient has the teeth in place and in edentulous cases the plate can be used if it is not lost. This plate can be used with a dental tray and molding compound and this is attached to a suitable headgear. This headgear may be made of various materials as surgical web, tape or adhesive plaster. The rigid headgear made of guttapercha and tape as advocated by Kazanjian is probably the most satisfactory.

In this a guttapercha band is molded to the forehead and secured by surgical tape around the head. To this guttapercha band attachments can be made for elevating the depressed bone or exerting pressure where needed. (Fig. 53.)

Rig. 53.—Headgear for holding fractured superior maxillary and nose.

In some cases the author has shaved the head and placed a broad adhesive tape from the back of the neck to the forehead and over this one or two layers of adhesive tape is placed, giving opportunity for attachment of the supports. Silkworm suture or wire can be attached to a tooth, brought out through the cheek and attached to a headgear. This, however, allows but one angle of traction and could not be adapted in all cases. In complete fractures, where the maxilla drops downward or the alveolus is separated, a Kingsley splint can be placed in the mouth and wired to the teeth, if present, and the arms of this splint, which extend outward on

either side of the mouth, are attached by tape and rubber bands to the headgear. In cases not to extensive it is often possible to hold the jaw in place by using a chin piece which is attached to a headgear, thus using the lower jaw as a splint. The objection to this method is that it is hard to overcome the muscle action of the lower jaw, feeding is unsatisfactory and breathing is usually difficult, as the nose, as a rule, has been injured and is occluded by packs and swelling. Where the external wall of the antrum is comminuted and depressed and the malar bone driven into the antrum, the author opens above the alveolus, as in a radical antrum operation, and elevates the fractured bone. When the malar bone has been driven into the antrum, grasping it with a hooked tenaculum externally can be combined with this method. All pieces of bone that have any firm attachment are pushed up into place, but the pieces which are loosened almost entirely are removed. As a matter of fact, considerable bone can be removed without any noticeable after effects. Because of the abundant blood supply in the face, necrosis of the bony fragments rarely occurs.

After replacing the bone, vaselin gauze is placed in the antrum through the opening made above the alveolus. This can be left in place several days before removing and repacking, and the author has found that at the time of the first dressing there is little danger of the bony fragments becoming displaced, as already an exudate has been thrown out which tends to hold the fragments in place. The antrum is filled with blood in the comminuted fractures, so that the antrum drainage is a very important factor, as these blood clots almost invariably become infected. At the time of the operation a large antromeatal opening is made under the inferior turbinate to allow for drainage after the packing has been discontinued. In fractures of the frontal sinuses, if there is bleeding, the clot as a rule becomes infected and drainage is important. The posterior wall of the sinus or base of the skull may be fractured and a

meningitis follow. A very careful observation of the sinuses should be made with a radiogram, if possible, and drainage instituted where there has been bleeding into the sinuses. In extensive fractures of the frontal, where the radiogram shows the frontal cloudy and there is a suspicion of fracture through the posterior wall, external drainage of the frontal sinus is indicated.

The depressed malar bone may be elevated best by grasping it through the skin with a sharp hooked tenaculus forceps and bringing it into place. Elevation of the bone may be made in this manner much easier, as a rule, than by making an incision through the skin and introducing a hook or elevator, although this latter method is still used by some. There is little difficulty in keeping the bone in place after reducing the fracture, as a rule, but the fragments may be wired if necessary. Where the zygoma is displaced outward, firm pressure is necessary over the prominence to reduce it, and it may be necessary to use continuous pressure from a wire attached to a headgear to bring about the gradual reduction.

Fractured nasal bones are pushed into place with a blunt elevator used intranasally, and if not comminuted too much will remain in place or can usually be held in place with an intranasal splint. The author has seen little benefit from external splints in the majority of cases. If the bones are badly comminuted and will not remain in place a mold may be made of the nostrils intranasally with dental compound. To these molds wires are attached, which are bent over the nose and anchored to a headgear or if the superior maxilla has been fractured, may be attached to the appliance used in the mouth, thus holding the comminuted nasal bones in place. In lateral displacements of the nose, particularly where the nasal process of the maxilla has been fractured, it may be almost impossible to reduce the fracture and hold it in place, and in these cases external pressure can be applied to the side of the nose by attach-

ing wires to the headgear. Depressed comminuted fractures of the nose may also be elevated by putting a pin through the nose externally and anchoring this to the headgear. While the writer does not advocate external splints, he has found it advisable at times to make a light mold of dental compound which is placed over the dorsum of the nose, which will aid in holding the comminuted bones in place and give protection from without.

In many of these cases of extensive fractures of the face the absence of pain and discomfort is very noticeable, and often the patients show but little concern about the treatment. In extensive fractures of the superior maxilla and alveolus there is usually little pain in manipulating the parts so that the work can be done under local anesthesia. This is probably due to the anesthesia produced by the stretching or compression of the maxillary division of the fifth nerve. As has been stated, union takes place early in fractures of the facial bones, so that by the second or third week the bones are quite firmly united.

Miscellaneous Nasal Conditions

Self-Disinfecting Power of the Nasal Mucosa. It is noted in this Editorial[2] that the ubiquity of bacteria is a matter of common knowledge. The micro-organisms are so widely distributed in our environment that the opportunity for contamination is manifold. As a consequence, a variety of defenses have been developed to protect us against our bacterial enemies. The sound skin is the foremost barrier against invasion; but even if the integument becomes insufficient for protection, various types of cells and circulating chemical substances may be requisitioned. Gay has recently said that any one who has carefully followed the evolution of the science of immunology must feel certain that in many of the protective processes there is concerned some third, as yet not clearly

(2) J. A. M. A., July 14, 1928.

understood, factor in addition to the mobile polymorphonuclear phagocytes of the blood stream and the antibodies. The oral and nasal cavities might seem to furnish more ready opportunity for the ingress of bacteria. Those that enter with the food are likely to find their nemesis in the unfavorable mediums they encounter in the gastro-intestinal tract. The micro-organisms in the dust that may be carried into the nasal tract during respiration are legion. Winslow and Kligler found, for example, more than 51,000 colon bacilli and 42,500 acid-forming streptococci per gram of dust from city streets. Such considerations lend significance to the observations of the autosterilizing power of the nasal mucous membrane reported by Arnold, Ostrom and Singer, who studied the average rate of disappearance of bacteria sprayed on the mucous membrane of the nose. In 400 tests on forty-two normal persons, the average number of viable bacteria thus introduced was estimated at 20,000,000. From 90 to 95 per cent of the latter were rendered nonviable within five to ten minutes. Swabs taken from the posterior pharyngeal wall showed that the bacteria are not removed to an appreciable extent by being passed into the throat from the nose. As many as eight successive seedings of the same bacteria at thirty minute intervals were placed in the nose; yet there was no evidence of any exhaustion of the disinfecting mechanism. Cultures obtained from the bacteria that have survived the initial period of disinfecting action were removed as promptly as the original strain from the nasal mucosa. Repeated applications did not lead to the development of a resistant strain. Environmental temperature (such as climatic variations might represent) were not without some effect on the autosterilizing power. Persons placed in a cold room (45 F., humidity 30 per cent) did not differ in the self-disinfecting power of the nose from that found in the ordinary room temperature (70 F., humidity 70 per cent). The same subjects placed in hot rooms (95 F., humidity 90 per cent)

showed a retardation in the removal of sprayed bacteria. In from forty-five minutes to an hour the bacteria had disappeared. The rapid reduction of 90 per cent of the inoculated dose within five minutes did not usually hold for the hot room environment. We are thus reminded that this self-disinfecting power of the mucous membrane of the nose of healthy volunteers may be of major importance in explaining the failure to seed the nose and throat with bacteria in influenza and other respiratory epidemiologic studies.

Irrigations with Aqueous Solution: Their Effect on the Membrane of the Upper Respiratory Tract of the Rabbit. The rabbits experimented on by W. B. Stark[3] were grouped as follows: (1) eight rabbits were irrigated with 0.9 per cent sodium chlorid solution; (2) five were irrigated with tap water; (3) seven were irrigated with 2 per cent sodium chlorid solution; (4) eight were used as controls, and (5) four were irrigated with 2 per cent sodium chlorid solution.

Five (63 per cent) of the eight rabbits in the first group which were irrigated with 0.9 per cent sodium chlorid solution had mucopurulent sinusitis; four (80 per cent) of the five rabbits in the second group which were irrigated with tap water had mucopurulent sinusitis; and nine (82 per cent) of the eleven rabbits in the third and fifth groups which were irrigated with 2 per cent sodium chlorid solution had mucopurulent sinusitis.

Eighteen (75 per cent) of the twenty-four rabbits irrigated had mucopurulent sinusitis, and twelve (67 per cent) of these had bronchopneumonia; thirteen (54 per cent) of all the rabbits irrigated had bronchopneumonia, and of these, twelve (92 per cent) had mucopurulent sinusitis. The nasal mucous membrane of all irrigated animals appeared thicker than the membrane of the control animals and suggested the presence of edema.

Because of the finely irregular structure of the infer-

(3) Arch. Otolaryng., July, 1928.

ior turbinate, the specimens of mucous membrane from this area were not satisfactory. The specimens from the middle turbinate, the lateral wall, the floor, the septum and the maxillary sinus presented a fairly uniform picture in the control rabbits, varying for the most part only with the site from which they were taken. The epithelium in the sections from the controls showed, besides the columnar cells arranged in layers, goblet cells of varying number and size. In most sections, the cilia stood out well on the epithelial surface and in many sections the epithelium was thinly covered with mucus. The membrana propria next to the epithelium was usually clearly shown, being formed of a single layer of cells. Beneath this layer was the tunica propria with its fibro-elastic tissue, mixed mucous glands, blood vessels and an occasional group of lymphocytes.

All the sections of irrigated mucous membrane showed changes from normal. The epithelial cells were larger and their outlines less distinct than in the normal mucous membrane. Cilia could seldom be seen. The goblet cells were distended, and in many sections, in place of the thin layer of mucus on the epithelium of the control animals, there was a heavy layer of mucus, polymorphonuclear leukocytes and epithelial débris. In some sections, the cells of the membrana propria were distinctly outlined as a single layer, but in most sections the outline was indistinct and often the layer was irregularly thickened. The tunica propria showed an increase in the number of leukocytes. The blood vessels were dilated, the cells of the mixed mucous glands were swollen, and the lumen of the gland was filled with mucus.

At the beginning of the investigation, it was hoped that it would be possible to irrigate satisfactorily one side of the nose and use the other side as a control. This was found to be impracticable, because the irrigating solution bathed both sides.

It seems reasonable to assume that the changes in the

mucous membrane of the nose of a human being as the result of irrigation would be similar to those occurring in the nose of the rabbit, and that such changes may account for the "waterlogging" in the irrigated nose of man. Edema, per se, of the rabbit's nasal mucosa was not demonstrated in the sections; it may, however, have been present and not detected. The increased fulness of the mucous membranes as a result of the increase in glandular activity, the increase in size of the vacuoles because of the increased content and the enlargement of the individual epithelial cells occurring as part of the inflammatory process would, in themselves, adequately account for the waterlogged appearance.

The solution and not the number of irrigations was probably the greater factor in determining the degree of reaction of the nasal mucosa. As has been noted, nine of eleven rabbits irrigated with a 2 per cent sodium chlorid solution and four of five irrigated with tap water showed the presence of mucopurulent sinusitis at necropsy, while five of the eight rabbits irrigated with 0.9 per cent sodium chlorid solution showed gross evidence of sinusitis. Microscopic study of these membranes disclosed corresponding variation in the degree of inflammatory change shown.

The number of rabbits irrigated was not large, and from the standpoint of statistical evidence, the different results obtained with the three solutions do not prove that one solution was more irritating to the nasal mucosa than another. However, the observation suggests that an isotonic solution may be less irritating to the nasal mucosa than a hypertonic solution.

Whether the inflammatory changes in the mucosa were the result of infection following irrigation, or of mechanical irritation of the mucous membrane, was not investigated. The observations suggest, however, that mechanical irritation played a definite part.

The pneumonia in the irrigated rabbits was, with one exception, confined to those having mucopurulent sinu-

sitis; that is, of the eighteen rabbits twelve had pneumonia, and in only one rabbit in which there was no evidence of sinusitis was there any suggestion, grossly, of pneumonia.

Tissue Changes in the Nasal Mucosa. Preliminary Report. H. P. Finck[4] has made a microscopic study of the nasal mucosa as found in various pathological conditions. As a result of these investigations he arrives at the following summary:

1. The term "physiological inflammation" is suggested as a useful means to describe great variety of states, from a microscopical point of view, in which the resting or average nasal mucosae of human beings are found to occur.

2. The degree of physiological inflammation found is an index of the susceptibility of the patient to develop abnormal nasal states or disorders.

3. There are several distinct types of physiological inflammation characterized by definite relative changes in the amount or numbers of certain tissue elements. The clinical signs and symptoms exhibited by the patient can usually be surmised from these definite microscopical pictures.

4. The significant cells in the majority of tissue changes are the lymphocytes, plasma cells and eosinophiles. The eosinophiles are strikingly abundant in conditions that are commonly considered as purely vasomotor and anaphylactic, where there is no obvious neutroture of purulent exudation. In general, polymorphonuclear neutrophilic leucocytes seem to be of lesser importance than the above cells.

5. It is suggested that the development of an increasing state of physiological inflammation in the nasal mucous membrane is an expression of the lowering of resistance (in the wide sense used by immunologists) in that organ.

6. Abnormal nasal states, such as congestions with

(4) Laryngoscope, November, 1927.

sneezing and watery discharge, polyps, polypoid and cystic formations, can apparently occur independently of any noticeable bacterial influence. It seems that in many people the proper functioning and resistance of the nasal mucosa is altered by reflexes sent to it from some other organ in the body which is abnormally stimulated; for example, from a skin which is sensitive to or has a lowered threshold to changes in temperature.

7. Bacteria are placed in a secondary role in the causation of abnormal states. A "preparing of the soil" seems to be necessary for them, just as there must be for proteins or chemicals, before they can become pathogenetically active.

Influence of the X-ray on Acute Inflammation and Special Reference to Mucous Membranes. Although others have stated that it is impossible to influence inflammations in closed cavities lined by thin membrane, that is, the accessory sinuses, Mittermaier[5] experimented on the hard palate of rabbits, making injections of diphtheria toxin and producing necrosis of the mucosa of the hard palate. He shows photomicrographs of the ulcerative process in control animals, and an absence of ulceration in those irradiated twenty-four hours after injection. In those irradiated three days after injection, there was a definite line of demarcation as compared with a spreading process in the controls. The author realizes the difference between an open sore subjected to the rubbing of the tongue and open drainage as compared with the nasal sinus. He also experimented with silver nitrate catgut buried in the tissues of guinea-pigs. Irradiation of these animals greatly reduced the reaction time and the time required for restitution of integrity.

He is now conducting experiments to determine the influence on more superficial, so-called catarrhal inflammations, but he concludes that there is no doubt that inflammatory processes may be favorably influenced by irradiation.

(5) Ztschr. f. Hals-, Nasen-u. Ohrenh., 18:260, 1927-1928.

His technic consisted of 1 10 Holzknecht epidermal dose of 150 kilovolts, 35 cm. focal distance and a filter of 3 mm. aluminum.

Vasomotor Rhinitis; a Clinical Study. Vasomotor rhinitis is a symptom complex manifested by sneezing, nasal discharge, nasal obstruction and, at times, lachrymation. It occurs more frequently in females than in males. A well developed case will give the following history: It continues throughout the year with periods when the symptoms are milder than at other times. Never are the symptoms entirely absent. When the patient gets out of bed and places the feet on the floor, sneezing begins and continues anywhere from one-half to two hours. This is accompanied by profuse nasal discharge of a thin consistency. Following this the nose becomes obstructed. The symptoms abate during the middle of the day, only to recur during the latter part of the afternoon. Some patients sleep well, while others are disturbed by nasal obstruction.

The nasal tissues during the quiescent period are slightly redder than the normal mucous membrane and more moist. While an attack is in progress, the mucous membrane of the nose is anemic, the normal pink color is hardly discernible, and all the tissues give the impression of being oversaturated with a large quantity of liquid. The nasal passages are narrowed, due to swelling of the mucous membrane and mucus in large quantities is seen to issue from many places.

The etiology of this condition is based upon a number of factors. M. J. Gottlieb[6] believes it is rare for one causal agent to produce the symptoms above enumerated. The establishment of this idea of etiological factors in vasomotor rhinitis is based entirely on the results of treatment of the various abnormal findings uncovered after painstaking examinations.

This condition is akin to the other allergic phenomena, such as hay-fever, eczema, urticaria, asthma and angio-

(6) Laryngoscope, October, 1927.

neurotic edema, in so far as there undoubtedly exists a fundamental congenital bodily predisposition to such manifestations. In most of the cases other members of the family or antecedents will be found to have or have had either vasomotor rhinitis or related conditions.

On careful search any of the following abnormalities may be uncovered: Sensitiveness to proteins; sensitiveness to autogenous bacterial suspensions; abnormal blood chemistry figures; abnormalities in the nose; abnormalities in the ductless glands; reduction in hearing capacity, very much akin to otosclerosis.

It is unusual to find that only one condition exists which when remedied produces an abatement of the symptoms. More commonly, two or more abnormal findings are uncovered—one of these is usually the fundamental or underlying factor—the others, the exciting cause. Occasionally no etiological abnormality is found; in this instance relief from symptoms cannot be expected.

Among the allergy the most common finding is a sensitiveness to substances such as feathers, animal hair, horse dandruff and house dust which may contain a great variety of substances. Tobacco, orris root, powdered ipecac and the dust of furs may produce this condition. In relation to this phase of the subject, each patient presents his or her particular problem. In some the industry, in which an individual works, bears a definite relation to the complaint. Hay-fever is not considered in this connection because it is a seasonal allergic reaction; however, the combination of pollen and other sensitization has been observed many times. During the hay-fever season, the patients' symptoms are aggravated.

That bacterial sensitiveness is a common cause of vasomotor rhinitis is attested by the comparatively large number of beneficial results obtained with autogenous vaccines on those who are sensitive to bacterial suspensions of organisms found in the various tracts in the body where bacteria abound. This variety of cases is

susceptible of division into three groups: (1) the cases which show an allergy to bacteria isolated from the nose, throat and mouth; (2) those which are sensitive to bacteria obtained from the intestinal tract; (3) those cases that react to bacteria isolated from both the intestine and the upper respiratory tract and mouth.

Cases that occur in the first group, those sensitive to bacteria isolated from the nose only, are rare. There is bacterial sensitiveness without apparent intranasal disease. The blood chemistry is normal. Cases that show sensitiveness to bacteria isolated from the intestines are quite common. Cases that are sensitive to autogenous bacteria isolated from the nose, mouth and intestines are peculiar in so far as the great majority have abnormal blood chemistry figures, essentially a high uric acid and low calcium content. They also have an associated allergy to food or inhalation proteins, and as a rule show satisfactory improvement with treatment.

[A very satisfactory summary of the facts that have been established regarding one of the most troublesome symptom complexes which the rhinologist is called upon to treat.—Ed.]

Fissures of the Nose. Recently R. L. Sutton[7] has been impressed by the frequency with which the dermatologist is consulted regarding simple fissures of the anterior nares. The condition must be a comparatively common one, for he has seen 27 cases within a period of less than 5 years. Practically all (26) of his patients were women, between the ages of 35 and 55 years. In the majority of instances, only one side of the nose was involved.

The lesions occur at the anterior angle of the opening, and, while scarcely perceptible to the eye of the examiner, are very persistent, and give rise to considerable pain and discomfort. Not infrequently there is a secondary, streptococcic involvement, which may cause

(7) J. A. M. A., Aug. 25, 1928.

slight fever and some intermittent redness of the tip of the organ.

Dryness of the nasal mucosa and rosacea probably are provocative factors, but why the condition is almost wholly limited to women of middle age, the writer does not know.

At various times during the past fifteen years, a number of different plans of treatment have been tried. Stimulating antiseptics, such as iodine and silver nitrate, are of little value. Ointments containing ammoniated mercury, or one of the iodides of mercury, are comforting and helpful but seldom prove curative. Occasionally a light radium reaction, such as would follow the brief application of a tiny, unscreened 5 or 10 mm. radium plaque, is followed by the disappearance of the offending lesion.

The most effective agent, however, is a needle-pointed electric cautery. With this modern "microbrenner" the raw surface, previously put on the stretch by means of a nasal speculum, is carefully "ironed" out. Afterward, a dressing of ointment of yellow mercuric oxide (2 per cent) is applied. As a rule, relief is prompt and permanent.

Lesions of this type undoubtedly have long been familiar to rhinologists, and it is very probable that other men have employed the microcautery in their eradication, but if so, the author has never learned of it.

The method is so simple, convenient and effective that it is well worthy of wider adoption.

A Rational Treatment of Hypertrophic Rhinitis. L. Feldman[8] has treated fifty cases in the last six years, using physical therapeutic measures. The cases were definitely diagnosed and had been treated with other measures without any relief. The author notes that obstruction is one of the most constant symptoms of the condition. Both sides of the nose may be obstructed;

(8) New England J. M., May 17, 1928.

or one side may be closed and the other remain free, or it may alternate from side to side.

The author's treatment consists of a monopolar, high frequency current, applied by means of a non-vacuum flat nasal electrode inserted into one side of the nose. The current is gradually turned on and the spark gap regulated, producing a slight tingling sensation, the electrode later becoming comfortably and tolerably warm. It is kept there for about ten minutes, thus producing, after this preliminary treatment, a rather marked hyperemia of the previously pale, boggy hypertrophied membrane; the mucous membrane is now ready for the subsequent treatment.

A flat copper nasal electrode covered with cotton and moistened is then applied against the tissues intranasally and attached by means of an insulated wire to the "active" positive pole of a galvanic apparatus, the larger indifferent moistened pad, size six by four, coming in contact with the patient's chest in the sternal region anteriorly. In the meantime, the mind and hands of the patient are kept busy holding the pad in place. Then the current is gradually turned on, taking into consideration both the patient's feelings and the milliampere meter reading. The average dosage is about three to eight M.A. for about ten minutes; then the entire process preceded by the high frequency treatment is repeated in the other side of the nose. By means of the copper electrode there is a certain amount of copper ionization taking place, copper oxychlorid being deposited in the tissues with additional antiseptic and astringent effects.

The average number of treatments given is ten and the interval between treatments about forty-eight hours. The average duration of treatment was twelve minutes. In the 50 cases observed and treated, the results were as follows: relief or improvement was first noticed after about the fourth seance, manifested by both symptoms and signs, subjective and objective, as described by the patients and checked up by the results of repeated

examinations during the course of treatment and observation, and later by interviews personally and by means of correspondence and communication over a period of approximately five years. The author's conclusions are as follows: total number of cases treated 50, total number of treatments given 512; total number cured, 28, (56 per cent) ; total number improved 12, (24 per cent) ; total number unimproved 10, (20 per cent). Eighty per cent, therefore, were entirely cured or relieved. These figures seem almost unbelievable, but the facts and the cases stand out as their own evidence and proof.

It is the writer's opinion, therefore, that if there were a concentrated effort on the part of the medical profession in general and of the laryngologists in particular, especially those connected with large clinics and having ample opportunity, facilities, and material to carry out some further research in this and other fields of endeavor in the various branches of medicine, that the true, unbiased, conservative opinions and value of physical therapeutic measures in the treatment of so-called various chronic and acute disease conditions might yet receive a new stimulus of hope through physical therapeutics, the most recently accepted adjunct to our therapeutic armamentarium.

Roentgen-Ray Examinations in Ozena. G. Ferreri and L. Parola[9] note that the various theories and treatments of ozena seem to be contradictory and at variance with each other. Some authorities believe that ozena originates as a primary infection and by recurrences finally invades the periosteum and bone. Others believe that it concerns the bone originally. Others maintain that it is a disease of the sinuses and their osseous walls, and that the nasal condition is secondary. Among the English, ozena is ascribed chiefly to syphilis and tuberculosis, but the authors contend that few syphilitic and tuberculous patients are found among the large mass of patients with ozena and that the occurrence of these diseases is coin-

(9) Arch. internat. de laryng., July-August, 1927.

cidental. Antisyphilitic treatment is of little value in a large majority of ozenas.

Lautenschlager sectioned the heads of thirty children, who succumbed to acute infectious diseases, and noted the lesions of the nose and accessory sinuses. He believes that ozena has a definite relation to the acute diseases of the sinuses in childhood. The authors, while admitting his theory as the most plausible, believe that many other conditions display a number of the characteristics he emphasized.

The parasitic theory, particularly that of Perez, is discussed at length, but does not seem acceptable because the condition cannot be reproduced experimentally, and vaccines do not seem entirely specific.

The therapeutics of ozena has not been satisfactory and, in fact, almost suggests charlatanism. The authors do not object to cleansing methods and means of disguising the odors. They do not condemn physiotherapy and simple means of narrowing the nasal passages, but they cannot subscribe to extensive operative procedures in the nose that neither cure nor relieve ozena.

A radiologic study was made of 100 patients from 15 to 35 years of age with ozena. The usual intranasal conditions of ozena were found. Study of the sinus resulted in the following statistics:

Maxillary sinus: increase of transparency, 7; unilateral decrease of transparency, 3; arrest of development, 3; normal, 64. Ethmoid sinuses: rarefaction, 46; unilateral decrease of transparency, 2; normal, 46. Frontal sinuses: increase of transparency, 14; enlarged sinus, 16; arrest of development, 36; normal, 19. Sphenoids: transparency increased, 6; transparency diminished, 2; enlarged sinus, 2; normal, 90.

The conclusions reached were that ozena is not of sinus origin, but that the sinuses are secondarily affected or involved by conditions foreign to ozena. If the condition were of sinus origin it should have more effect on the remainder of the respiratory tract and the ears.

Conservative Septum Operation, Clinical and Experimental Contributions. In the modern treatment of deformation of the septum, N. A. Pautow[1] notes that old ideas have come to the front again. They have appeared in a new form and are carried out with a new technic. The question arises whether or not too much of the septum is removed in Killian's operation. In atrophic rhinitis, or, in latent inclination toward this condition, Killian's radical operation is not indicated. A firm nasal septum is necessary when a simultaneous correction of deformities of the external part of the nose is desired. This is not possible with Killian's operation. Various intranasal operations require only mobility of the septum in order that a better approach to the field of operation may be obtained; for instance, West's operation. The classic Killian's operation cannot be accepted as a universal operation in deformities of the septum. More conservative measures have been suggested; for instance, implantation of excised cartilage. Experiments on animals have shown that excised and replaced cartilage does not produce new cartilage, and that it is resorbed. The other principle of conservative surgery is exemplified by the methods of detachment of the mucous membrane only on one side, and by the removal of none of the skeleton of the septum, or of only parts which are deformed, or which must be removed in order to preserve the size of the septum. The greater part of the skeleton, and especially the cartilaginous portion, is mobilized by incisions and fractures but remains connected with the mucous membrane of the opposite side. It is placed in a perpendicular position. This method has been used in the clinic of Wojatschek for ten years. The conservative procedure requires expert technic.

Four types of operations are named: (1) Mobilization: After detachment of the mucous membrane on one side, the quadrangular cartilage is repeatedly incised without penetrating the mucous membrane and perichon-

(1) Ztschr. f. Hals-, Nasen-u. Ohrenh., Oct. 28, 1927.

drium of the opposite side. The skeleton is fractured in proper places with the chisel, sometimes with Killian's speculum. A mobilized septum results which can easily be shifted to the opposite side in order to obtain a better approach to the lateral wall of the nose for intranasal operations. After a time, the nasal septum becomes rigid again. (2) Redressment: The mobilization can be done on the straight septum; the redressment has as its aim the straightening of deflections. The deflections are incised and fractured submucously, but left in connection with the mucous membrane on the opposite side. The septum is then shifted to the middle line and fixated in this position. (3) Circulary resection: This operation is performed in deflections of the cartilaginous portion of the septum. According to the principle mentioned before, two concentric circular incisions are made in the cartilage. The ring created in this manner is detached also from the mucous membrane of the opposite side and excised. The central portion of the cartilage (the disk) remains, and can be shifted into the desired direction and fixated in this position. (4) The partial resection is a further development of these modifications. If it appears that the combination of the circular resection and redressment does not insure a sufficient straightening of the septum, the spurs and spines are separated from the mucous membrane of the opposite side and removed. The combination of one of the three methods with partial removal of some parts of the skeleton is called partial resection.

The author performed 106 resections of the septum in the year 1925-1926, 16 according to the technic of Killian, and 90 according to that of Wojatschek. The incision in the mucous membrane was not stitched. Packings were introduced into both nostrils. The packing was left for 24 hours in the side with the intact mucous membrane and for 48 hours in the other. For one or two days, cotton plugs were placed in the nostrils.

Follicular tonsilitis was observed five times. In one

instance, angina was complicated by appendicitis. The swelling of the septum lasted for from seven to nine days. With some patients, the swelling persisted. In two instances, the redressment was done on patients suffering from unilateral ozena and a pronounced deviation of the septum in order to narrow the nasal cavity affected by ozena (method of Mermod). Wojatschek states that the nasal septum remains movable for a few weeks.

Experiments were carried out on pigs. They have massive septum and sufficiently wide nostrils. The experiments were as follows: (1) resection of the cartilage according to the method of Killian; (2) resection of the cartilage with reimplantation (the implant was left between the lamellae of the mucous membrane); (3) separation of the mucous membrane from one side of the septum; (4) detachment of the mucous membrane on one side of the septum, incisions and fractures of the cartilage reaching to the mucous membrane on the opposite side (mobilization or redressment).

Histologic investigations were made six months later. Investigations after mobilization or redressment in the pig showed that the septum had become entirely firm and elastic and consisted of an uninterrupted cartilaginous structure, viewed macroscopically. Yet, the cross-cut showed that the incisions in the cartilage were filled with perichondrium which was connected with the perichondrium which covered the cartilage of the septum. To a certain degree, the cartilage of the septum possessed the faculty of regeneration from the perichondrium. This faculty was not pronounced, and negligible from a practical point of view. Fractures of the bone healed after six weeks, but the incisions and fractures of the cartilage did not show any callus even after six months.

[A timely discussion of a clinical problem which every rhinologist with sufficient clinical experience to be able to make his own evaluations has found it advantageous to consider. The idea that a complete submucous

resection is the one way, and the only way, of correcting septal conditions has led to unnecessarily extensive operative procedures, with the result that there is often left a loose relaxed membrane between the two nasal passages which for all practical purposes might as well be removed entirely with in most instances no appreciation of the patient that he does not have the membranous septum. The aim should be to correct the obstruction by the simplest method possible. This means a submucous resection, or a modified submucous resection, in most instances, but it does not invariably mean the type of complete resection with which the beginner in rhinology is likely to be hipped and which has led unfortunately to no small number of depressed nasal bridges.—Ed.]

Cartilage and Ivory in Plastic Surgery of the Nose. S. Salinger[2] has operated on several patients in cases of this type, and up to the present has found that the implants are well borne. It is important to avoid distending or stretching the tissues. He has found that the only point at which pain may be elicited is at the nasal spine, against which the columellar implant rests. This, however, tends to become less pronounced as time goes on.

Cases of extrusion of ivory implants have been reported some time after operation, but in nearly every instance the operation has been performed through an intranasal incision. It is the author's belief that bringing the ivory too close to the surface of a mucous membrane has been the responsible factor. Mucous and submucous tissues are not dense enough to resist the constant pressure of a hard substance like ivory. For this reason, as well as on account of the lesser likelihood of infection, the author employs the skin incision through the columella, for here it is possible to avoid the surfaces of the mucous membrane and to introduce the ivory

(2) Arch. Otolaryng., December, 1927.

through tougher tissues into its fibrous bed, where it is best tolerated.

For the time being, he is inclined to favor ivory over cartilage for the repair of saddle-noses, or flat tips, because it is easier for the patient, there is less chance of infection, and the ivory will not be affected by the host. Whether or not the converse of the latter is a fact, remains to be seen. At the present time, implants inserted more than a year ago are securely in place, the surrounding tissues do not show any sign of ejecting the stranger and the cosmetic results are ideal. Should the conditions remain undisturbed for a longer period of time, the writer may feel more secure in the hope that an ideal material for nasal implantation has been uncovered to take the place of costal cartilage.

Foreign Body in Nose, Diagnosed as Carcinoma Unexpectedly Removed. This is the case of a girl, age 16 years, whose illness so far as could be ascertained began Dec. 27, 1926. Her previous personal history was not significant except that she had been suffering with headache for the past seven years and that she had been without her sense of smell for five months. Her illness began with a chill that lasted a few minutes. In addition she had a severe headache. That same day she had a flushed, painful face and complained of a general weakness.

At this time there was a swelling over the left malar region which also involved both lids of the left eye. Her condition was diagnosed as erysipelas. At the end of two weeks her erysipelas had cleared up but it was noted that there was an abscess draining profusely through a small opening in the region of the inner canthus of the left eye. She was shortly after seen by the ophthalmologists, who treated her local eye condition. On Jan. 12, 1927, an incision was made into the swollen area near the inner canthus but very little pus was encountered.

Her local condition continued unchanged until March

15, when M. C. Myerson[3] was asked to see her. At this time there was a draining sinus in the naso-orbital region, and she complained of left frontal headache. A diagnosis of perforation of the ethmoidal labyrinth was made. The nasal examination revealed a left nasal chamber filled with an irregularly granular mass which obstructed the nasal passage. This mass bled profusely when touched with a probe. It was thought that there was a neoplasm of unusual vascularity. The roentgen report was as follows: "There is a marked decrease of illumination of the left ethmoid sinus area extending into the naris. There is also involvement of the maxillary sinus of this side. The findings suggest a new growth."

Six days later the patient was taken to the operating room, where it was the author's purpose to perform an external operation of the Moure type, for the radical removal of the new growth. When the patient had been anesthetized, the extent of the involvement and the bleeding, which was quite profuse at the slightest contact of the probe, led the writer to abandon the operation.

It was decided to remove a specimen and then to determine whether operation at a future date would be advisable. In attempting to remove a specimen with a pair of punch forceps, the instrument seemed to remain fast in the tissues, and could not be dislodged. In trying to disengage the forceps, a sudden lack of resistance was felt, and the forceps were removed attached to an irregular, hard, inflexible body, impregnated with blood and tissue juices, and covered with granulation tissue. It was 4½ inches long. Upon examination this proved to be a piece of gauze. The nose was packed with iodoform gauze and a postnasal tampon was used for the control of hemorrhage, which was profuse. The bleeding prevented an examination of the nasal structures to determine the extent of the damage which had been caused by the lodgement of the gauze.

It was not possible to obtain a history of any experi-

(3) Laryngoscope, June, 1928.

ence which might have a bearing upon the nasal condition from the patient or members of the family. Thirteen days after removal of the foreign body the patient was discharged well.

Familial Epistaxis without Telangiectasia. Four such cases are reported by H. Z. Giffin,[4] occurring in both men and women and the heredity has been both maternal and paternal. Although there are not sufficient data with respect to the family histories to prove that the heredity follows the mendelian law, the epistaxis does not appear to be a recessive characteristic. While generalized purpura was not present in any of the cases, petechiæ were found in the mouth in one case and purpuric areas in the nose in another. The four cases show one striking feature in common: a somewhat reduced platelet level on repeated counts. All other features of coagulation were essentially normal. In contrast to this, the author's own cases of familial epistaxis with telangiectasia have shown a normal platelet level. These facts suggest quite definitely that the condition is not hemophilic, and may be purpuric.

Two well-marked cases of recurrent epistaxis without telangiectasia but without a family history of epistaxis have been noted. Selected from a larger number of less definite cases of recurrent epistaxis, these show more clearly than the familial types the characteristics of mild hemorrhagic purpura.

Inquiry suggests that cases of mild recurrent epistaxis beginning in childhood and lasting for variable periods are quite common; the persons affected do not, as a rule, consult a physician. Many cases of this type are doubtless caused by local conditions in the nose, but it may safely be inferred that some of them are due to changes in the blood.

The characteristics of cases of familial epistaxis without telangiectasia, of those of recurrent epistaxis without telangiectasia but without familial history, and of

(4) Am. J. M. Sc., November, 1927.

the one family with recurrent adolescent epistaxis reported by Lane, indicate the probable existence of a familial form of purpura. A study of the abnormalities and familial characteristics of platelets which may be expected to elucidate the problem is under way. Some familial abnormality of the platelets would best explain the clinical facts.

Ligation of the External Carotid Artery for Persistent Nasal Hemorrhage. B. H. Abrahams[5] believes that ligation of the common carotid is resorted to at times when simple ligation of the external carotid is the only procedure indicated.

In ligating the external carotid an incision about 3 inches (7.6 cm.) long is made along the anterior border of the sternomastoid muscle, the middle of which is opposite the upper border of the thyroid cartilage. This enables one to tie the artery near its origin below the point where it is crossed by the digastric muscle. After exposure of the bifurcation of the common carotid artery, the external carotid will be seen to lie medial and somewhat anterior to the internal carotid artery. The ligature is applied between the origin of the superior thyroid and lingual branches. After ligation, the circulation is slowly reestablished by the free communications between most of the branches of the artery and the branches of its fellow of the other side. Ligation of one external carotid artery arrests the circulation for only a brief period, and within a few days the circulation is completely reestablished. A great number of small vessels in the midline join the external carotid of one side to that of the other. Ligation of both external carotid arteries produces only temporary anemia. Dawbarn points out that even after excision of the external carotid artery, with separate ligature of its eight branches, blood can still reach the nose, tongue and other structures from other sources.

The author reports a case of a man, aged 31, who

(5) Arch. Otolaryng., July, 1928.

had repeated hemorrhages following operation on the right ethmoid-sphenoid region. The usual means of controlling hemorrhage, including transfusion, were of no avail. Ligation of the external carotid proved effective. Subsequent examination revealed a positive Wasserman, causing the author to feel that the sphenopalatine vessel may have been involved in a syphilitic process, which prevented normal retraction and thrombus formation.

Rhinoscleroma. F. A. Figi and L. Thompson[6] have recently seen three cases of rhinoscleroma. This is unusual since the condition is quite rare in this country. Rhinoscleroma is a chronic infectious granuloma caused by the Frisch bacillus. It produces hard nodules in the nose, pharynx, and larynx, and these often break down forming considerable distortion and scarring of the tissues. The process may start in the nose and spread to the pharynx and larynx, or it may be primary in either locality.

Rhinoscleroma is intimately associated with lack of hygienic surroundings, and is usually found in the countries of central and southeastern Europe, or Central America.

Characteristic of the histopathology are the large Mikulicz cells, in which may be found the intracellular diplococci. The diagnosis may be confirmed best by biopsy and culture of the discharge. The clinical picture often resembles syphilis, leprosy, lupus, atrophic rhinitis or pharyngitis with ozena, sarcoma and carcinoma.

In respect to treatment the authors employed radium with quite good results. The prognosis is best in cases where the lesions are in the nose or pharynx, and poorest when the larynx is involved. They report six cases in all, and in conclusion give the characteristic bacteriological reactions of the causative organism.

(6) J. A. M. A., Sept. 1, 1928.

Cephalocele Intranasalis. W. Edel[7] reports the case of a boy, aged 18, who was said to have suffered from nasal polyps soon after birth. These were removed first when he was 9 months old. A continuous watery discharge from the nose was reported. Polyps were removed repeatedly, until a greater intervention under general anesthesia, during his fourth year, gave the patient relief. He suffered frequently from severe headache, especially above the nose. During these attacks, he acted dishonestly and even committed burglaries, whereas at other times he was industrious, kind hearted and intelligent.

Examination revealed the fact that the left side of the nose was almost completely filled with a grayish-white smooth tumor with a shining surface. The roentgenogram showed absence of frontal sinuses and cloudiness of both ethmoids and of the left maxillary antrum. A portion of the tumor was removed for examination. A probe, carefully introduced, entered the cranial cavity without resistance. The specimen contained tissue of the central nervous system with a covering of connective tissue.

Five days later, the patient complained of headache; six days later, in addition, he suffered pain while swallowing, and, during the following night, he vomited. The next day, the patient was restless and dazed, and showed a positive Kernig sign. An operation was performed according to the Jansen-Ritter technic, and the frontal lobe of the brain was elevated in order to reach the sac of the hernia, which was extending into the nasal cavity through an opening, 1.5 by 1 cm., in the lamina cribrosa. The sac was joined to the bone at its posterior border; also to the septum. Respiration became difficult, and the patient died on the operating table. Necropsy was not permitted.

Intranasal encephaloceles have been observed by Richter, Cruveilhier, von Meyer, Fenger, Kayser, Schoetz,

(7) Ztschr. f. Hals-, Nasen-u. Ohrenh., 19:163, 1927.

Nager, Froboese and Lenhoff. Only one patient (Fenger's) or, perhaps, two (Lenhoff's), survived an operation. Nevertheless, surgical intervention is contraindicated. The diagnosis is difficult. Only Nager diagnosed his case without operation; he, however, made a trial puncture, a procedure which might not always be harmless. One should consider the possibility of intranasal encephalocele and resort to trial puncture rather than to trial excision or trial snaring if the anamnesis, appearance, compressability, transillumination, roentgen-ray examination and irrigation of the maxillary sinus do not lead to diagnosis.

Nasal Disease in Relation to Asthma. J. Dundas-Grant[8] strongly urges that in all cases of spasmodic asthma the nasal septum and middle turbinals should be inspected and, if open to suspicion, dealt with by the usual rhinological methods. Especially important is the contact of the middle turbinate with the sensitive part of the septum.

To use a fairly illustrative analogy, the asthmatic predisposition may be looked upon as a cartridge which can only be made to explode by means of a detonator, and among the several possible detonators the middle turbinal in contact with the septum is one of the most active. In the same way, the detonator cannot cause an explosion in the absence of the charged cartridge, and contact between the middle turbinal and the septum does not cause asthmatic attacks unless the asthmatic tendency is present. The ideal treatment is to remove or neutralize the cartridge, but, short of this, the most obvious means of relief is to remove the detonator.

[The removal of the anterior end of the middle turbinate in cases where contact with the tuberculum septi is aggravated because of the middle turbinal body being tightly wedged in between septum and the outer nasal wall is a nasal condition which prevents ventilation and drainage of the ethmoid and is a stimulant to the de-

(8) Practitioner, December, 1927.

velopment of the hyperplastic ethmoiditis so often found associated with spasmodic asthma. The correction of this condition by the resection of the middle turbinal body is the treatment which relieves nasal symptoms and often influences favorably asthmatic attacks when these come on.—Ed.]

Diseases of the Mouth

Changing Concepts Concerning Oral Sepsis. The long series of experiments in animals that have been performed by E. C. Rosenow[9] and others leaves no doubt that the elective power of the bacteria in foci of infection largely determines the location of the systemic lesion or disease a person with foci of infection is likely to develop.

This statement should not be taken to mean that this always occurs independently by predisposing factors. Exposure, trauma and fatigue of certain structure, improper food and bad sanitation, lack of sunshine, alcoholism and other excesses, undoubtedly lower the threshold of local or general resistance and thus greatly increase the likelihood of elective localization of bacteria and other infective processes.

In order to remove all doubt regarding the importance of latent foci of infection as an important factor in the production of disease, Meisser and the author have produced latent foci by devitalizing and infecting the teeth in dogs, thus closely simulating the conditions often inadvertantly induced in persons by dentists. Nephritis, nephrolithiasis, ulcer of the stomach, spasms of the diaphragm and other muscles, and chorea have been produced in this way with culture isolated from patients with these respective diseases, and in each instance the causual relationship of the organism introduced into the teeth to the metastatis lesion has been established

(9) Kentucky M. J., October, 1927.

by the demonstration of the organism in the lesions and focus and by the elective localizing power of the strains isolated. During the latter experiments, another important fact was noted: The bacteria in the induced latent focus of infection, besides producing the characteristic disease, appeared to exert general deleterious effects. The animals lost weight and became more susceptible to intercurrent infections, although they were kept under conditions identical with those of control animals. In other words, conditions of hygiene and diet that were adequate to maintain weight and health in normal dogs were inadequate for dogs with latent foci of infection. The harm, therefore, from improper food or sanitation may be greatly exaggerated by bacteria harbored in foci of infection; a point not yet sufficiently considered.

Still other important facts have been brought to light. Streptococci having the same specific localizing power were demonstrated in more than one focus in the same persons simultaneously, and, in some instances, at intervals, in one or more foci, over a long period. These experimental facts are in harmony with the common clinical observation that persons affected with a particular disease, such as iritis, ulcer or arthritis, are prone to have recurring attacks of the same disease, which often tends to become chronic in character. In the light of these facts, the possibility that the tissues or fluids of the body afford the conditions on which the development of the peculiar localizing power of bacteria depends must be seriously considered. The hereditary tendency observed in some of these diseases also points in this direction, as does the repeatedly made observation that a higher incidence and more marked lesions occur in the character organ or tissues of animals infected with the organisms from foci at the time of acute attacks or during acute exacerbations in chronic affections than during quiescent intervals. Moreover, well-marked differences in the incidence and severity of specific lesions were noted at different seasons of the year, espe-

cially in chronic ulcer and arthritis. During the colder months, when exacerbations and an increased incidence of these diseases are so common, the incidence of positive results in animals was appreciably higher than during the warmer months, when patients were relatively or entirely free from symptoms.

The reasons for the elective localization of bacteria are still obscure. No doubt the same principles that determine the localization or pharmacologic action of chemicals and drugs apply here.

The practical applications of the principles of focal infection and elective localization are fraught with many difficulties. Systemic diseases, once thoroughly established and often associated with anatomic changes that in themselves may continue to give rise to symptoms even though there are no organisms present, may continue after all evident foci are removed. The instances of cure or arrest of progress in systemic diseases by the removal of foci of infection are so numerous that search for and removal of all foci possible is indicated in almost every case of serious systemic disease in which there is good clinical or experimental evidence of focal origin. In a given case the variations in the invasive power of the bacteria, the wide differences in natural or acquired resistance to microbe invasion in different persons and at different times, the age and sex, the history of previous attacks, the duration and character of the disease from which relief is sought, and hereditary tendencies must all be considered in determining when, or whether, all or certain foci should be removed, or whether the condition is indeed of focal origin.

To arrive at a correct diagnosis and to manage focal infection properly often requires the advice of specialists in the various branches of the healing art, as well as that of a competent bacteriologist.

[The author very properly emphasizes the difficulty of the clinical problems arising from the teachings concerning focal infection. First is the difficulty in not

being able to recognize what conditions are produced by foci of infection, but a much greater difficulty is the question of determining where possible foci are located, and finally, most difficult of all is the problem of eliminating such foci. It is not difficult to understand how the clinician, who may be naturally devoid of a clinical poise, jumps to conclusions which lead to unnecessary surgical procedures. While one looks upon accumulation of lymphoid tissue no larger than the head of a match as a plausible focus for systemic infection, provided only that this lymphoid tissue be found located in the scar of the enucleated faucial tonsil when he will be quite willing to ignore the same lymphoid accumulations scattered promiscuously over the posterior wall of the pharynx; another advocates the removal of teeth where the skiagraph gives only a suspicion of possible alterations around the apices or where there is a devitalized tooth with no tangible alterations about the apices; and another recommends and actually carries out extensive radical operations on the paranasal sinuses, now the ethmoid, now the sphenoid, but most frequently the maxillary sinus, depending on what is his own peculiar mental bias regarding these sinuses, in cases where a patient is suffering from a condition which is suspected to be a systemic infection of focal origin and even in cases where there are no tangible local symptoms suggesting sinusitis where the intranasal examinations, transillumination, and skiagraphy are all negative and where in operating a thin membrane is found lining the cavities. Because in some of these instances, in spite of the operation, the patient happens to show chance improvement he jumps to the conclusion that his treatment has demonstrated that the region operated on was the focus for all the trouble.—Ed.]

Diathermy for Cancrum Oris. Cancrum oris is fortunately now a rare condition, according to G. G. Turner[1]. Nevertheless examples turn up from time to

(1) Brit. M. J., Aug. 18, 1928.

time renewing interest and arousing responsibility. A close association with a considerable number of cases during the last thirty years has taught him how very serious the prognosis usually is, and how inefficient most of the methods of treatment.

On March 30th of this year, a child suffering from this condition was admitted to the Royal Victoria Infirmary. There was a large black patch of gangrenous tissue about the size of half a crown over the horizontal ramus of the lower jaw on the right side, and this was surrounded by a zone of acute inflammation, with swelling of the side of the face and neck. At one point the edge of the gangrenous area had separated, and there was a small amount of very offensive discharge. The buccal cavity was not infected. The temperature was 102.8°, and the child was toxic and profoundly ill.

While pondering over the best method of treatment, it occurred to the author that complete excision by the method of diathermy might cut short the infective gangrenous process. Under a general anesthetic the diathermy knife was applied about half an inch from the edge of the black mass to include the spreading edge, and a free circular excision was carried out. To remove all the dead tissue it was necessary to go right down to the bone. After this complete excision about 1½ in. of the body of the jaw lay exposed at the bottom of the wound and subsequently necrosed. The area was packed with gauze and external dressings applied. The condition of the patient under the anesthetic gave much cause for anxiety, but she soon picked up, and almost from that moment commenced to make a satisfactory recovery. The temperature fell at once and remained at normal, with the exception of one or two days at the end of a fortnight, when there was a mild outburst of surrounding inflammation, but without any of the characteristics associated with infective gangrene. During the sixth week the patient was able to leave hospital, and progress continued uninterruptedly afterwards. On July 18th

the sequestrum was obviously loose, and was lifted out by the family doctor. Afterwards the area soon healed, leaving a surprisingly small scar.

This is the first occasion on which the author has used diathermy for acute gangrenous necrosis of this kind, but the result has been so satisfactory as to encourage him to employ it in future.

Surgical Procedures and Radium in the Treatment of Cancer of the Mouth and Throat. According to G. B. New[2] the use of radium in the treatment of cancer of the mouth and throat is a striking example of the misuse of a very valuable therapeutic agent.

Owing largely to the education of the public by the medical profession, many more patients with small chronic fissures or leucoplakia of the lips, or minor ulcerations of the tongue or throat, are presenting themselves for treatment fearing the possibility of cancer. One rarely sees, at the present time, a patient with extensive cancer of the mouth or throat who has not been under the care of a physician.

Of equal importance to the education of the public is the education of the medical profession to give the best possible treatment to these patients with early lesions of the mouth and throat.

Before the advent of radium, the patient with a suspicious ulcer of the mouth or throat presented himself to a surgeon who excised the lesion, either with knife or cautery, for microscopic diagnosis. If the lesion proved to be malignant, the gland-bearing fascia that drained the area was removed. If it proved to be benign, the patient was well-rid of the trouble and no further treatment was necessary.

Today such lesions are frequently treated with radium by the radiologist, the dermatologist, or the physician with a small amount of radium at his disposal. Following this, one of two things may occur. The local lesion clears up entirely, only to recur, however, in the lymph

(2) Surg. Gynec. Obst., June, 1928.

nodes of the neck in a few months or years, or the local lesion becomes more active and metastatic nodes appear in the neck. Frequently when these nodes appear, the patient has a tooth removed believing it to be the cause. Later the mass in the neck is explored and found to be an inoperable, metastatic carcinoma.

In cases of cancer of the larynx, removal of the growth by thyrotomy, with or without removal of the cartilage or laryngectomy, offers the patient the best chance of cure in the intrinsic case. Although radium has been used and is still being used in intrinsic cancer of the larynx, the end-results are not good and the sloughing of the cartilage which frequently follows is sometimes disastrous. Recently Portmann and Harmer recommended removal of the cartilage from both thyroid cartilages, leaving only a frame of cartilage in order to avoid secondary sloughing, and then using radium directly against the growth. Although their results indicate that this may be of use in inoperable cases, it should not be used if the lesion can be removed surgically. In this country, radium is generally used in the treatment of extrinsic epitheliomata of the larynx; operation is not attempted. Sir Wilfred Trotter performs lateral pharyngotomy, which is a great advance in the surgical treatment of growths of the epiglottis, aryepiglottic folds and the postericoid region. Trotter reported the results of his first work in 1913 and has since perfected the procedure. After removal of postericoid tumors, he reconstructs the upper end of the œsophagus and pharynx with a flap turned in from the neck. In many of his cases the condition was entirely cleared up by surgical removal.

Radium has, however, a distinct place in the treatment of cancer of the mouth and throat, but it is being used at the present time in the treatment of many lesions for which it is doing more harm than good. Patients with rapidly growing, extensive cancers of the tongue and antrum, who could not possibly be benefited

by any surgical procedure have been entirely cured of their trouble by radium. Radium seems to be of help in pre-operative and post-operative treatment. It should not be used, however, to treat the questionable primary lesion, which should be excised for microscopic diagnosis, nor should it take the place of the removal of the gland-bearing fascia of the neck.

What has been accomplished by radium in the treatment of cancer of the mouth and throat has been overshadowed by the number of inoperable cases that have increased at least 25 per cent, as a result of its indiscriminate use in the treatment of the primary lesion, and of nodes of the neck.

Diathermy Operations for Cancer of the Tongue. W. D. Harmer[3] believes that diathermy is an excellent method of treating cancers of the mucous membrane in any part of the upper air passages, particularly those that are easily accessible, such as carcinoma of the tongue. To obtain good results it is most important to take strict precautions against sepsis. In every case septic teeth should be removed before the operation. When the ulcer of the tongue is foul, it should be completely coagulated and dried before any attempt is made to remove it.

Except for the treatment of small localized growths, general anesthesia is advisable; preferably a nitrous-oxid oxygen-chloroform mixture should be given.

Preliminary laryngotomy and preliminary ligature of the lingual or external carotid arteries are rarely necessary. Fulguration is suitable for the treatment of patches of leukoplakia, and coagulation for the smaller ulcers which originate either on the tongue or the floor of the mouth. Coagulation followed by excision has been abandoned in favor of circumvallation. A fine needle is used to coagulate the healthy tissues around the growth, and with the same needle and current the ulcer is completely coagulated. The affected parts are then

(3) Brit. J. Surg., April, 1928.

excised with the diathermy knife and the wound surface is seared by fulguration.

Dermoid Cysts Above and Below the Diaphragm of the Mouth. In reporting two cases J. V. Meigs[4] discusses these dermoid cysts in considerable detail. Above the floor of the mouth and just beneath the floor of the mouth they may arise from epithelial inclusions which come theoretically from the following possible points: (1) the narrow region before, in and behind the median portion of the lower jaw (where the mandible unites); (2) the median portion of the hyoid bone where both halves of the second and third branchial arches grow together; (3) the region between the lower jaw and the hyoid in the middle line or just to one side where the first and second branchial arches grow together; (4) the region below the cornua of the hyoid bone where the second and third branchial arches grow together. Most of them are probably derived from ectoderm shut in during the closure of the first and second branchial arches.

Histologically the walls of the cyst should show tissue resembling that of skin. That is, the cyst should contain hair and the walls show hair follicles and sweat and sebaceous glands. Grossly the walls externally are yellowish-white, thick, tough, fibrous, and shaggy. Inside, they are smooth and shiny and the contents of the cyst may vary from a yellowish, soupy material to thick, white, greasy, caseous matter.

The mylohyoid muscle is the diaphragm separating the inside of the mouth from the neck. It is a hammock-like muscle with a median raphe. Along the surface of it, near the raphe, run the two geniohyoid muscles, which fan out to be attached to the hyoid bone posteriorly and below. Dermoid cysts above the floor of the mouth rest beneath the sublingual gland and upon the mylohyoid and against the centrally located geniohyoids, while dermoid cysts beneath the floor of the

(4) New England J. M., March 29, 1928.

mouth are medial to and behind the submaxillary gland and extend to the hyoid bone and rest against the geniohyoid, the mylohyoid and the anterior belly of the digastric. The cysts above the diaphragm of the mouth, are, of course, in close proximity to Wharton's duct and the lingual nerve, and those beneath the floor of the mouth are in close relation to the hypoglossal nerve, lingual vein and artery, and facial artery.

The cysts may be divided into median cysts and lateral cysts. The median cysts may be further divided into "the geniohyoid cysts, those resting upon the mylohyoid muscle and spreading the floor of the geniohyoid muscles apart, and the genioglossal cysts, those resting upon the geniohyoid muscles and pushing the genioglossi apart." The lateral tumors occupy "the region above the mylohyoid, beneath the mucous membrane of the mouth."

The tumors of the floor of the mouth are seen as swellings under the tongue and push downward into the submental region. While ranulae are usually laterally placed, the tumors lie nearly in the midline and the sublingual gland on one side or the other is pushed up closer to the underneath part of the tongue. In one of the cases reported, the swelling under the chin was mistaken many times for a very peculiar double chin. This should have ruled out sublingual ranula which does not project below the jaw. The tumor caused pressure on Wharton's duct and one of the patient's chief complaints was swelling in the side of the neck during eating or after seeing tomatoes, lemons and the foods that caused salivation. It was this occasional swelling that caused the patient to consult a physician. The appearance underneath the tongue is yellowish white rather than bluish as in ranulae. Cysts beneath the floor of the mouth cause a swelling from the angle of the jaw towards the hyoid bone. A suppurating gland from a tooth might be suspected, or a cyst of the submaxillary gland. A submaxillary ranula usually bulges

into the floor of the mouth and also projects below the jaw. If there is doubt, an exploratory puncture with the discovery of the characteristic sebaceous material should at once suggest the diagnosis.

In the differential diagnosis of these cysts ranulae must be considered as of most frequent occurrence, but puncture and bearing in mind the usual position of the sublingual and submaxillary ranulae should give a definite clue. Lipomata are usually pedunculated and appear in the dorsum or edge of the tongue. Fibromata are usually pedunculated, occasionally sesile, but a deep-seated growth may be impossible to recognize. Angiomata nearly always reach the surface and are identical with cutaneous angiomata. Circoid aneurysm is occasionally met with, but its humming pulsation should rule it out at once. Chondroma and osteoma are rare. Aberrant goitre of the suprahyoid or lingual type might be confusing. The suprahyoid type is centrally located, forcing apart the mylohyoid and the geniohyoid muscles. The lingual type is situated under the mucous membrane at the base of the tongue. These two forms of aberrant goitre must be differentiated from the lingual dermoid, or dermoid beneath the floor of the mouth, and the dermoid of the floor of the mouth. The goitres are always situated in the midline, a point of considerable importance. The lingual dermoid is never exactly in the midline. Lymphoma must of course be considered in the differential diagnosis. Adenoma and papilloma of the tongue are easily ruled out, as the former is in the body of the tongue itself and the latter usually of or attached to the tongue proper.

The treatment of both types of dermoid cyst is surgical; that is, complete excision. Those on top of the diaphragm are best removed under local anesthesia, through an incision in the floor of the mouth. The sublingual gland is turned medially and the tumor shelled out of its bed with the finger. If there has been no suppuration, this is easily done. The lingual dermoid, or

more descriptive, the dermoid beneath the diaphragm of the mouth, can be reached by an incision below and parallel to the ramus of the jaw. The submaxillary gland is then pulled laterally and with the finger the cyst is shelled out of its bed as it lies against the mylohyoid and geniohyoid muscles.

Glossopharyngeal Neuralgia. According to A. Fonio[5] the glossopharyngeal bears a close resemblance to the trigeminal nerve in the structure of its roots and ganglions and in the symptomatology of its neuralgia. The pain may begin at the base of the tongue or in the tonsils or pharynx, and may radiate to the ear, eye, or the angle of the lower jaw of the same side. The attacks of pain resemble those of trigeminal neuralgia in their intensity, mode of onset, duration, remission and intervals. The attacks may be provoked by speaking, coughing, chewing, swallowing, drinking, or by pressure on the tonsillar area or at the lower angle of the jaw. The etiology, as in the case of the trigeminus, is unknown. The excised nerve in the author's case did not show any pathologic change. The aneurysmal dilatation of the common carotid artery present in his case was a probable factor, because of irritation of the internal carotid nerve, the carotid plexus, the corda tympani and the petrosal ganglion. Ligation of the artery had the effect of preventing attacks for some time. The third ligation, however, failed to arrest further attacks.

Exeresis of the nerve as close to the jugular foramen as is possible is the simplest and most rational procedure. Neither alcohol injection of the ganglions nor their removal as practiced in trigeminal neuralgia should be attempted, because of the proximity to the jugular vein, the vagus, and the spinal accessory nerve within the jugular foramen. Intracranial dissection of the root as practiced by Adson is so formidable a procedure, that it should be reserved for stubborn cases only, or for those in which recurrence after exeresis takes place. An im-

(5) Deutsche Ztschr f. Chir., January, 1928.

portant aid in the differential diagnosis consists in cocainizing the tonsillar area and the base of the tongue. If an attack takes place in spite of this, then it is due to the trigeminal and not to the glossopharyngeal nerve.

Angina Ludovici and Kindred Affections: An Historical and Clinical Study. H. S. Muckleston[6] notes that suffocative infections of the throat have been known and described since the days of early Greek physicians. Until the nineteenth century an exact classification was impossible. Diphtheria, scarlatinal angina, quinsy, retropharyngeal abscess and other less severe diseases of the throat were grouped under the generic name cynanche. Ludwig of Stuttgart described, in 1836, a particular form of phlegmon involving the tissues around the salivary glands and in the cervical region.

The anatomic planes of the floor of the mouth and of the neck, both muscular and facial, determine the spread of the disease. The primary cause is frequently local affections of the mouth or trauma. The commonest finding is caries of molar or premolar teeth. Streptococci are always present.

The pathology is that of a cellulitis, spreading from the tissues around the salivary glands to the opposite side of the throat and to the neck. Submaxillary and cervical tissues take on a boardlike hardness, but there is not a superficial edema. Abscess formation takes place in over half of the cases. The mediastinum is likely to be invaded. Pulmonary complications are infarction, plastic and hemorrhagic pleurisy, bronchopneumonia, atelectasis.

The aggressive symptoms are dyspnea, alteration in the voice, dysphagia. The constitutional symptoms are those of toxemia.

Treatment is supporting and surgical. Intravenous therapy is not established as curative, but has been found of advantage in some cases. Surgical exploration, either for drainage of an abscess or for relief of tissue

(6) Ann. Otol., Rhin. & Laryng., June, 1928.

tension, should be early and searching. Pharyngeal abscesses are indicative of cervical suppuration; their safest approach, when this is possible, is by an external route. The mortality of reported cases is approximately 40 per cent.

Diseases of the Throat

The Tonsils

The Tonsil Problem: The Research Work of the Viennese Clinic. The histologic and experimental results obtained by R. Waldapfel[7] are definitely proved by clinical observations. Carcinomas in the region of the sinuses, turbinates, soft parts of the pharynx, pillars, uvula and other areas cause metastases in the known regional glands, but never in the tonsils. These results prove that a tonsillar disease coming from the nose by way of the lymph stream does not exist; that the three tonsils are not lymph glands, and that the tonsillar tissue is not different from the remaining lymphoid tissue, which is divided in a greater or lesser degree throughout the pharyngeal mucous membrane. As the lymph current from the pharyngeal mucous membrane follows the general law of flowing centripetally to the regional glands and not in the opposite direction, the same holds true for the tonsils, since they are merely a part of this mucous membrane.

There is still one point to be mentioned: In the lingual and pharyngeal tonsils, the contiguous mucous glands open into the crypts. In the palatine tonsils, this hardly ever occurs. In agreement with this anatomic fact is the clinical observation that plugs occur rarely in the lingual and pharyngeal tonsils, probably because here they are washed out by the mucus.

The research work of Schlemmer dealt with anatomic and physiologic details. In the subsequent investiga-

(7) Arch. Otolaryng., August, 1928.

tions of the Viennese clinic, the problem was attacked from the bacteriologic standpoint. To determine whether streptococci have anything to do with the clinical picture of tonsillitis, Waldapfel had injected into his cubital vein 20 c. c. of the blood of a patient with tonsillitis (whose temperature at that time was 103.1 F.) and one day later rubbed into his own tonsils, after previous scarification, a smear from the diseased tonsils. Both experiments gave negative results. A reaction could not be seen. One observation, however, pointed a certain way for further investigations. Having examined the phagocytic power of his blood against the streptococci from the patient before and after this experiment, he found that it had definitely increased following the injection.

There then followed a further series of examinations in this direction. The conclusions from these were: (1) Tonsillitis cannot be transferred by inoculation from tonsil to tonsil or by the transfusion of blood from diseased to healthy persons. (2) The phagocytic power of the patient's blood against the streptococci cultivated from the patient's tonsils increases in direct ratio with the stage of healing, and the resistance of the organism against these streptococci increases likewise. (3) This increase in resistance of the organism is directed specifically only against the strain cultivated from the patient; against foreign strains the organism does not show an increase in the power of defense with progress of healing. (4) The streptococci in persons with tonsillitis are not accidental and secondary symptoms, but are in close relation to the disease and its course.

That the streptococci play a part was proved by these investigations, but the question remains unexplained as to how the inactive streptococci, normally harmless parasites on the tonsils, become such dangerous factors in tonsillitis. The next series of investigations was dedicated to this theme. They aimed at the solution of the question: Is it possible to find any factor which enables

the bacteria to develop and exhibit their power? If this possibility exists, it can occur only in an early stage before the typical clinical appearances characterize the disease. To find such cases is extremely difficult, but laryngologists, nevertheless, occasionally see such cases in which tonsillitis develops after nasal operations. Among numerous fruitless trials, it was possible in four cases to carry on the examinations at a time when clinical evidence of tonsillitis was not present, and the disease did not manifest itself until during the observation. When the blood from these four patients was used as a culture medium for the streptococci taken from the tonsils of the respective patients, these streptococci became much more virulent than when they were cultivated on normal blood or bouillon, and caused the death of mice in a fraction of the time required by the same streptococci cultured normally. The blood of these patients alone, injected for control purposes, was not infectious in any case. The combination of the blood of the patient alone, followed six hours later by an injection of bouillon culture of his streptococci, caused the death of the mice in a short time. The blood of a patient who became ill twice during the period of observation, once with tonsillitis and later with an abscess, showed the faculty of increase in virulence only during the early stages of the first disease.

The following conclusions are the results of these observations: Some unknown factor (whether designated by the name disposition or some other term is unimportant) activates the streptococci in tonsillitis. Perhaps the common cold may conceivably play the rôle by acting primarily as a disturber of the biologic equilibrium and enabling the secondary factor, i. e., the germ, to play its part. It seems certain that intranasal operations also may cause such a disturbance of the biologic equilibrium of the entire organism, and thus prepare the way for tonsillitis. And so from another phase of the question one finds the same result as Schlemmer did on

the basis of his anatomic investigations, i. e., tonsillitis occurring after nasal operations is not a regional reaction. Neither the last mentioned factor alone nor the streptococci alone are sufficient to cause the disease; there must be a combination of the two.

What takes place in the tonsils themselves during tonsillitis has been unknown until now. A proper consideration of this question was always prevented by the fact that the removal of tonsils during an acute inflammation was always avoided in this clinic. Finally, however, the desired material was assembled by reason of the occasional necessity of removing acutely inflamed tonsils in a suffocating child in order to obviate the need of a tracheotomy.

Grossmann and the author found that in the diseased tonsils the pathologic anatomic changes not only are superficial, but extend into the depth and concern a great part of the tonsillar parenchyma. The phlegmonous changes are in the foreground. Deep destruction of the lymphoid tissue is found even in the first days of the disease. Purulent foci of destroyed tissue, varying in number and extent, occur. What appears clinically as a plug not only is a cast of a lacuna, but is as often a branch of such a purulent focus of the tonsillar parenchyma extending to the surface. Exudate, as well as destroyed tissue, always contains the same flora of bacteria: a pure culture of gram-positive diplococci and streptococci.

The most interesting changes of the parenchyma appear in the lymph follicles. In the earliest stages of the disease which the author was able to study, aggregations of polymorphonuclear leukocytes and streptococci often existed in the inner part of the follicles (Fig. 54). These aggregations most often lie centrally, sometimes more excentrically; they seldom perforate the wall of lymphocytes and only rarely have a direct communication with the lacunae. In slightly more advanced stages,

these foci no longer contain cocci, and soon thereafter they are not found any more.

Up to the present time the prevailing opinion is that the infection passes from the surface into the depth after breaking through the epithelium of the lacunae. The author does not wish to state what is not yet proved, but

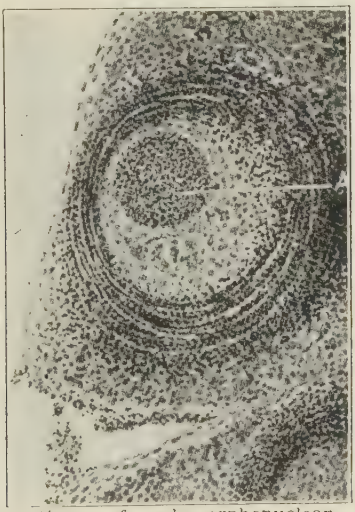

Fig. 54.—Aggregations of polymorphonuclear leukocytes and streptococci in the inner parts of the follicles. *A*, indicated focus of leukocytes.

on observing such a picture as Figure 4 presents, which also shows many foci confined to the centers of the lymph follicles, an unbiased observer must admit that the infection may take the opposite course, an opinion which gains more and more ground clinically. Bacteriologic examinations of these sections prove the results obtained in the author's former research work, namely. that streptococci are not accidentally found in tonsillitis, but that they are a part of the picture of the disease.

One fact has been brought out by this work: Whatever one's opinion may be of the function of the lymph

follicles and the germ centers, they are not exclusively, if at all, centers of production of lymphocytes.

The Muscular Attachments of the Tonsils. From a study of embryology and anatomy R. H. Fowler and T. W. Todd[8] arrive at some interesting conclusions. In the

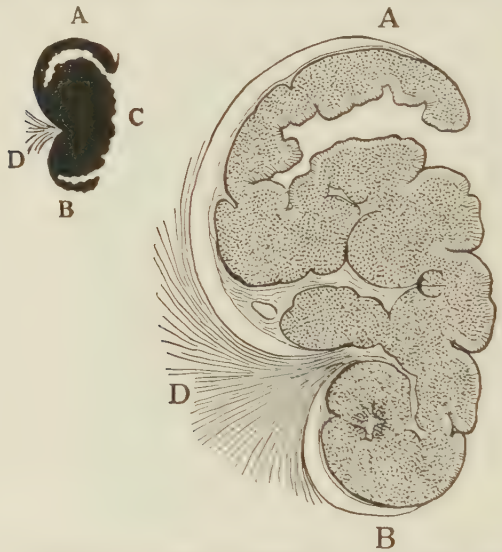

Fig. 55.—Diagram of tonsil showing: *A*, hoodlike upper lobe; *B*, pocketlike lower lobe; *C*, lymphoid mass; *D*, muscle attaching to capsule at equator.

embryo, tissues from the third branchial arch grow across the second pharyngeal pouch to form the palatal folds and soft palate. This divides it into an upper and a lower part. The adenoid develops in the former, the tonsil in the latter. The tonsil pocket shows a fold (plica introtonsillaris) which almost cuts it in half. This fold marks the junction of the upper and lower lobes. As the tonsil develops, the supratonsillar and infratonsillar recesses (adjoining the upper and lower lobes respectively) are separated from each other by the

(8) J. A. M. A., May 19, 1928.

overgrowth of the lining of the posterior wall of the fossa to form the central lymphoid mass (Fig. 55).

Dissections of the adult tonsil reveal the musculature

Fig. 56.—Dissection of left side of throat continued. At this stage the palatoglossus is cut and its lower part turned down along with the tonsil. Deep in the severed palatal portion are fibers of the levator palati which pierce the palate between bundles of the palatopharyngeus. The latter muscle, therefore, in sections of the palate, appears both above and below the levator palati. The coarse bundles of the palatopharyngeus form a special thick mass known as the posterior pillar of the fauces. The attachment of the lateral vertical fibers of the pharynx to the equator of the tonsil (tonsillopharyngeus) and branches from the lingual artery entering the equator are well seen. The large vessel supplying the capsule is shown piercing the lateral vertical fibers on its way from the descending palatine artery. Other branches shown reaching the tonsil equator are probably from dorsalis linguae. 1, levator palati; 2, palatopharyngeus; 3, superior constrictor; 4, palatoglossus.

of the tonsil bed as depicted in Figure 56. The authors therefore, conclude that:

1. To place tonsil surgery on a basis of scientific accuracy, it is requisite that the structure involved be

fundamentally correct. These structures are complicated; not only the tonsil but the pharyngeal fascia and related muscles.

2. The tonsil itself is a lymphoid-lined pocket.

3. The upper lobe is a hood and the lower lobe (from which springs the central mass) is a pocket. These are marked off from each other by a groove in the capsule.

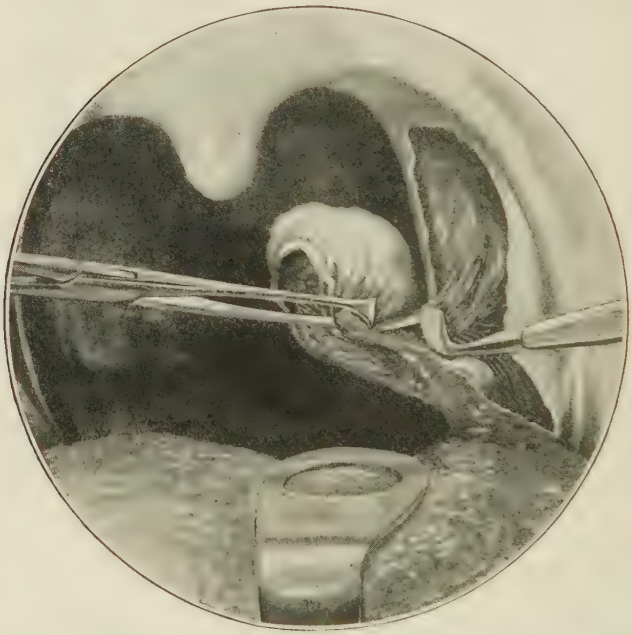

Fig. 57.—Surgical removal of left tonsil. Serrated edge of dissector (Fisher) is shown freeing the tonsillopharyngeus attachment from its groove.

4. The so-called capsule is a thin sheet of fibrous tissue left covering the tonsil after removal. It is an artefact created during the operation by the surgeon stripping away a layer of pharyngeal fascia.

5. The superior constrictor muscle is not an immediate relation, as the palatopharyngeus lies between it

and the capsule, to which it is attached at the groove between the upper and lower pockets by a bundle of fibers. This muscular attachment is called the tonsillo-pharyngeus muscle.

6. If this muscular attachment is teased through, complete enucleation of the tonsil can be carried out easily and without injury to the underlying structures (Fig. 57).

Pathologic Changes in the Faucial Tonsils. An analysis of 1,000 faucial tonsils is reported by A. S. Welch[9]. The tonsils were cut serially with a sharp scalpel and the cut surfaces carefully examined. Where it seemed indicated microscopic sections were made.

Of the tonsils examined, 43 per cent did not reveal any evidence of gross change whatever, and 28 per cent were not altered except for cheesy cryptic concretions. Only 7 per cent showed ulcerations or contained true abscesses. Scarring was noted in 22 per cent of the tonsils. Large pieces of muscle were attached to 13.9 per cent.

Incidence of Rheumatism, Chorea and Heart Disease in Tonsillectomized Children. Follow-up studies were made by A. D. Kaiser[1] of 20,000 children on whom tonsillectomy had been performed in Rochester, N. Y., from 1919 to 1921, and on 28,000 unoperated children who were used as controls. These patients were school children living in approximately the same environment. The work included a history of the child's infections, emphasizing the rheumatic syndrome, particularly in those who gave a history of chorea, rheumatism or heart disease. A careful search was made for other foci of infection. The date of onset of rheumatic manifestations relative to the time of operation was particularly determined.

The author includes acute rheumatic fever, joint pains and the so-called "growing pains." These oc-

(9) J. A. M. A., Dec. 24, 1927.
(1) Ibid., Dec. 31, 1927.

curred in 8 per cent of the operated children and in 10 per cent of the unoperated group. Many of the former, however, had had rheumatic symptoms before tonsillectomy. The author concludes that the tonsillectomized child has a decidedly better chance to escape rheumatic infection over the same period of time than the child whose tonsils have not been removed, and that recurrent attacks of rheumatic fever are less common in the group in which the operation has been performed.

The incidence of chorea was only slightly affected by operation, 0.4 per cent of the operated group being involved as compared with 0.5 in the unoperated group. Cardiac involvement after chorea was definitely less in the operated children.

Scarlet fever occurred in 7.6 per cent of operated children and 16 per cent of the unoperated group. Operated children have less tendency to develop valvular heart disease after scarlet fever than those on whom operation had not been performed.

Rheumatic disease was found in 450 of the 20,000 operated children and in 817 of the 28,000 on whom operation had not been performed. Many of the children in the former group developed heart disease before the operation. A careful analysis of 478 cases of carditis showed that in 83 per cent the condition developed before tonsillectomy and in 17 per cent, after tonsillectomy.

The author concludes that the tonsil is a factor in the causation of rheumatism, scarlet fever and chronic heart disease, and that the tonsillectomized child is assured greater protection against these infections than the child whose tonsils have not been removed.

The "Silent" Tonsil; Its Relation to Albuminuria. C. P. Jones[2] believes that routine tests will disclose the presence of albuminuria or other evidences of nephritis in the majority of cases of acute tonsillitis or other tonsillar infections. In cases of albuminuria of doubtful

(2) Ann. Otol., Rhin. & Laryng., September, 1928.

origin, careful examination of the pharynx may often determine the etiologic relationship of diseased tonsils.

Hypertrophy or severe inflammation of the tonsils is not necessarily an index of the etiologic relationship of the pharyngeal lymphoid tissue to renal involvement. Even small tonsils or a mild attack of tonsillitis may provoke marked nephritis.

Thorough enucleation of the tonsils, including the subtonsillar lymphoid tissue and adenoid vegetations assures the prompt cure and prevents the recurrence of the related albuminuria.

Surgical Diathermy of the Tonsils: An Easy and Satisfactory Technic. The contradictory opinions expressed by various writers on this subject has prompted E. W. Frecker[3] to present this article. The author believes that the reason for this difference of opinion is that in one case one technic has been used, in another, a different procedure. Consequently the results have not been uniform.

In the electrocoagulation type of surgical diathermy the temperature under the small electrode is raised to the point of coagulation, while that under the large electrode remains comparatively cool. The two leads are connected up to the machine so that it is a bipolar method. In tonsil work the large electrode is attached to the patient's back, while the active electrode is applied to the tonsil, the latter electrode consisting of a button, ball or needle in an insulated handle. A milliampere meter shows the particular amount of current that is passing. In this method the voltage is relatively low, the amperage relatively high, resistance of the circuit low and the available energy abundant. The effects of electrocoagulation on the tissues are those of slow penetrating heat with a deep cooking effect resulting in coagulation of the proteins. The form of electrode has a definite effect on the result, also the

(3) M. J. Australia, March 17, 1928.

intensity of the current and the rate of increase as it is applied. The author believes that electrocoagulation is, therefore, better or even a necessity for large tumors, but that it is dangerous for tonsil work except in the hands of an expert who can take the various factors into consideration.

In electrodesiccation the large electrode is dispensed with—it is thus monoterminal. The active electrode is attached to the highest voltage on the machine (Oudin). The current still passes to the patient and finds its way back to the source via the walls and air. The voltage is relatively high, amperage relatively low, no meter reading is present, the available energy very limited and the active electrode is always a needle, and inserted six millimeters into the tissue. This type of current is thus of most use for small operations, such as the tonsils.

A further variety of surgical diathermy is fulguration. In this method the active electrode is held a short distance from the tissue, which causes sparks to be rained down upon it. Either the bipolar or monopolar method can be used. Fulguration is of use in sealing vessels to stop hemorrhage.

The author presents the technic which he has found most satisfactory: The method is electrodesiccation and the particular machine a Watson Mark I with foot switch. The frequency is about 800,000 per second. The electrode consists of a copper or steel wire passing through a piece of glass tubing drawn to a point at one end like a pipette. Six millimeters (one quarter inch) of the wire sharpened to a point project from the pointed end of the glass tube, whilst the other end is turned into a loop to hook on to the lead from the high voltage terminal. Both ends are fixed in with sealing wax and the glass covered with rubber tubing to diminish the brush condenser discharge from the walls. This instrument can be made at home with complete efficiency in ten minutes and its manufacture is well

described in Massey's book on diathermy. One made with a double curve is also very useful. The essential point is insulation up to 6 mm. (one quarter inch) from the end to avoid accidental burns of the lips, mouth and tongue.

The instruments are simple—swab forceps, strabismus hook and tongue spatula with some 10 per cent cocain solution.

The complete operation consists of a number of sittings, one every week to each tonsil alternately so that each side receives a treatment once a fortnight. One tonsil only is treated at each session and usually about six sessions are necessary. The treatments, though extending over a long period, are so free from pain both at the time and afterwards that patients do not resent them.

The machine is arranged with the foot switch in circuit and the electrode connected up to the high voltage terminal (Oudin). The current control is set at Number 1 and the spark gap opened one quarter turn or until the electrode throws a 6 mm. (quarter inch) spark to a piece of metal held in the operator's hand. A fine blue spray can be seen coming from the point held against a dark background when the setting is about right. With the patient seated facing a good light, the needle is inserted 3 to 6 mm. (one eighth to one quarter inch) into the tonsil and the switch depressed until a white ring appears around the electrode. This usually takes about two or three seconds. Some bubbling or even a distinct pop may occur.

The process is repeated till the whole of the tonsil appears white, this, as a rule entailing twelve or fifteen punctures according to the size of the organ. It is best to commence with the most difficult portions, that is the lower pole and the margins under the anterior pillar. The whole sitting including the anesthesia takes only about ten minutes. The fingers are most efficient retractors and may be used without fear of shock or

burn, if kept away from the electrode in action. A metal spatula is also admissible while the strabismus hook is useful to hold away the pillars, in which case the patient will hold the spatula himself. No blood should be seen during the administration, but if any bleeding accidentally occurs, by simply raising the electrode from the tonsil and allowing the current to arc on the source, it is immediately checked. Lastly, as stated before, no meter reading is available in this circuit so that no amperages may be given to guide the operator. The after treatment is a simple mouth wash.

The technic results in a natural, undistorted fossa without the slightest sign of fibrous tissue or contraction. Hemorrhage or edema does not appear and the reaction is limited to a little soreness on the next day.

Tonsillectomy with Bloodless Technic. W. W. Walker[4] reports his method because he believes it prevents bleeding, and so prevents lung complications. The essential feature of the technic is the endothermy machine.

Ether is given, but not beyond the second stage. Adults are started with gas and oxygen. The patients should be put to sleep in an anesthesia room, and during operation the patient should have fifteen expirations after the anesthetic is stopped before the current is applied to the snare.

The technic of the operation is first to dissect the tonsil free from its pillars. Then with the tenaculum holding the tonsil out the wire snare is slipped over it and tightened. The current is turned on and the pedicle gradually cut through, leaving the fossa covered by a gray, thin film of coagulation. Occasionally a small bleeder will occur, but this is easily taken care of by sparking, which is sufficient to char it.

The author has performed 300 tonsillectomies by this method and has not had a single complication outside of six cases having mild postoperative oozing. The

(4) Ann. Surg., March, 1928.

small amount of after-pain is another feature of the operation.

[The question of bloodless tonsillectomy has been presented very often. We are reminded in the use of the cautery snare of the cautery dissections advocated over a quarter of a century ago claimed also to be bloodless. Theoretically it was bloodless, but practically resulted in severe secondary hemorrhages just as any method may. The claim for cautery dissections that they are painless afterwards is rather surprising. Cautery dissection, as formerly used, resulted in much more reaction than the ordinary enucleation with cutting instruments or the cold snare.—Ed.]

Postoperative Tonsillar Hemorrhage Due to the Organisms of Vincent: Report of Five Cases. Postoperative tonsillar hemorrhage from infection of the fossae by the organisms of Vincent is of comparatively rare occurrence. In an active clinical experience over a period of 15 years, A. P. Tibbets[5] has recognized this condition but five times. Strangely enough, all five cases have been observed within the last two years. While it is quite possible that some few cases of persistent postoperative bleeding in the past have been due to this type of infection, the writer does not recall any previous case that presented the characteristic symptoms which are associated with Vincent's infection.

The early recognition of this type of infection is extremely important, for the reason that the treatment is essentially different from that usually employed for postoperative hemorrhages. The patient may be saved much discomfort, and the surgeon considerable anxiety, by the early application of specific remedies.

Of the five cases reported, three were males and two females. All were young adults. Only one had had military service, having served in the navy. One girl's brother-in-law, who lived with the family, had had two attacks of trench mouth, for which he had been treated

(5) Laryngoscope, December, 1927.

by his dentist. In the other four cases there was no definite history of exposure. In all five cases both the spirilla and fusiform bacilli were recovered in sufficient numbers on direct smear to leave no doubt that they were the specific cause of the necrosis and ulceration which led to the bleeding.

There was a striking similarity in the symptoms of the patients. All complained of repeated attacks of tonsillitis, and of soreness and discomfort in the throat upon the least exposure to cold and dampness. They were all slightly under weight, anemic, easily tired, suffered from muscular pains, which at times were quite severe, and complained of an excessive amount of thick, stringy mucus from the membranes of the upper respiratory tract. Those seen following an attack of tonsillitis appeared prostrated out of all proportion to the severity of the attack, so that operation had to be postponed from two to eight weeks.

The postoperative symptoms were much the same in each case. In one patient the bleeding began five hours after operation, and in the others from two to seven days. Those patients in whom the bleeding started after 48 hours did not appear to be doing well. They complained of unusually sore throats on the day before the bleeding started, could not take nourishment and seemed prostrated and mentally depressed.

The hemorrhages came on suddenly, without apparent cause. In two cases from 250 to 500 c. c. of blood were lost within a short time. The blood clotted readily, filling the fossae, but there was a steady trickle from beneath the clot. In all cases there was a tendency for the spontaneous arrest of the bleeding at one point, only to have it break out at another, and then recur at the original site.

While there were no fatalities in this series, one of the patients was rapidly passing into an alarming state of exhaustion before the cause was recognized. This was due to the repeated hemorrhages, loss of rest, in-

ability to take nourishment, and the prostration which accompanies the disease. Once appropriate treatment had been started, improvement was rapid and the throat usually completely healed at the end of two weeks.

The most effective treatment consisted of rapidly cleansing the fossa of the clot and then making firm pressure with a gauze sponge wrung out in pure hydrogen peroxid. A string sponge moistened with peroxid was also left in the fossa for several hours, and upon removal the fossa was painted with a 10 per cent solution of neoarsphenamin.

Peritonsillar Infection. This report by S. D. Greenfield[6] is based upon an experience of approximately 290 cases. The author discusses the various ways in which the pus may dissect its way behind the tonsil, and stresses some of the atypical forms. Where previous scars act as distinct partitions two or even three abscesses may result. Peritonsillar abscess must be differentiated from retropharyngeal abscess, diphtheria, Vincent's angina and sarcoma of the tonsil. Among the complications the author mentions, general sepsis, hemorrhage, acute edema of the larynx, cervical adenitis with suppuration, polyarthritis, and acute endocarditis.

In regard to treatment the author believes that when a peritonsillar infection is established, it does not show any tendency to recede spontaneously. Therefore efforts should be directed toward hastening the progress of the suppurative process. This is best accomplished by the use of hot fomentations applied externally. Gargles are useless and extremely distressing. A great deal of comfort will be obtained by syringing the mouth and tonsillar region with warm alkaline solutions. The patient's strength must be conserved as much as possible, and pain should be relieved by the use of morphin in hypodermic injections. Catharsis and the administration of salicylates are also indicated.

(6) Arch. Otolaryng., March, 1928.

One of the most important considerations in the treatment of patients who have peritonsillar infection is the selection of the site for opening the abscess. When marked bulging is found in the supratonsillar fossa, one should look for pus above and anterior to the tonsil. The incision must be free and ample. The author prefers making the latter in a vertical direction over the point of maximum swelling. Some physicians prefer the transverse incision, but Greenfield has not seen that this has any advantage over the vertical one.

In patients in whom inability to open the mouth is pronounced, the pus will usually be located more externally, and the incision should be directed laterally. In those cases particularly the incision should be followed by the introduction of a pair of blunt pointed nasal forceps. This permits free evacuation of all the contents. The procedure may have to be repeated once or twice on successive days.

In those instances in which the pus descends into the posterior pillar, the latter must be incised before relief will be obtained. One will occasionally obtain pus in these cases by making the incision into the supratonsillar fossa. One should not be content with having located pus here, but should proceed to incise the posterior pillar in addition.

The procedure when an atypical peritonsillar abscess is present is a problem. Set rules cannot be made for these cases; each one must be considered individually, and the ingenuity of the surgeon is often taxed to the utmost. The symptoms and physical conditions at the time of examination will to a great extent determine the site of incision.

In cases in which pus appears to be present external to the tonsil, one should not hesitate to make an incision in this locality, even though it is necessary to cut through dense scar tissue. A procedure that seems to work exceedingly well in these cases is first to make an

incision and then to insert a grooved director in the direction in which it is suspected that pus is present.

In those instances in which pus appears to be deep-seated and one suspects its presence in the pharyngo-maxillary space, there should be little delay in incising the area. Deep and multiple incisions are often necessary if the pus cavity is to be located before further spread of the infection takes place.

The method of opening the abscess might be considered here. Some advocate the use of forceps and others the use of the knife. The author has employed a curved scalpel, the blade of which is short and the point narrow and sharp. The latter permits of its easy penetration into the tissues, and little pain is caused. General anesthesia is contraindicated. The operation consumes little time, and he prefers not to use a local anesthetic. It is important to clear the throat of mucus, especially in cases in which there is marked interference with movement of the lower jaw. Good illumination will greatly facilitate the operation.

The author refers to the more radical treatment for peritonsillar abscess recently advocated; tonsillectomy performed at the time of incision of the abscess. The procedure has not been in vogue long enough, and the number of cases in which it has been employed is not sufficiently large to ascertain the complications that may develop. At the best such a procedure is opposed to the well balanced logical tenets that govern treatment for suppurative processes in general. The fact cannot be disregarded, however, that many rhinolaryngologists most heartily advocate this radical removal of the tonsil during the acute stage rather than incision and drainage. However, this measure is of the most heroic kind. In those cases in which suffering is most intense and repeated incisions have not been sufficient to locate and evacuate the pus, one might, as a last resort, remove a good portion of the tonsil in order to reach the pus cavity. Technically, there is no doubt that careful

and complete removal is out of the question. With the edema and induration attending the inflammation, landmarks are obliterated. The normal lines of demarcation which ordinarily are the most important guides in a careful dissection are lacking. At the best, all the operator can hope for is the removal of most of the tonsil. In many instances one will find a secondary operation necessary in order to remove the remnant which in these cases especially is apt to be responsible for future recurrences. It is a much safer and wiser plan not to substitute such procedures, which may jeopardize the patient's safety and well-being more perhaps than the condition from which he is suffering and for which he seeks relief.

Treatment of peritonsillar infection should be of more than passing interest to the physician. It may through its mere presence or through involvement of adjacent structures give rise to more serious local and general complications which may at times have a fatal termination. The keynote to the avoidance of disaster, therefore, is early diagnosis with timely and adequate incision and drainage.

[The author's arguments against subjecting the patient to an operation for enucleation of the tonsils in the presence of an acute peritonsillar infection seems to me are sound. Enucleation of a tonsil where there has been a peritonsillar infiltration is difficult at best when there is no inflammation. These infections usually occur in adults where the local anesthesia is used for removing tonsils and the difficulty one encounters in getting an adequate local anesthesia in these situations is well known. Add to this the increased difficulty because of the acute inflammatory condition and it will multiply the difficulty many times.—Ed.]

The Pharynx

The Functions of the Pharyngeal Lymph-Ring. From his own consideration of this subject and the conclusions

of other writers F. P. Strum[7] believes that: (1) the production of lymphocytes does not take place in the germ centers, but in other parts of the lymphatic glands and nodules; (2) a tonsil increases in size chiefly because new germ-centers are required, not for the production of lymphocytes, but for their destruction; and (3) a cell possessing the power of phagocytosis is on its way to degeneration and death.

Tonsillar hypertrophy consists chiefly in an increase in the number and size of the germ-centers: In the "normal" or resting tonsil, which is practically found only at birth, the area of diffuse lymphoid tissue is greater than the combined areas of the germ-centers. In the hypertrophied tonsil the combined areas of the germ-centers are greater than the area of the surrounding lymphoid tissue.

In infective conditions there is evidence that leukocytes, laden with captured micro-organisms, come to the germ-centers for destruction. The destruction of cells and bacteria within the germ-centers, and the subsequent involution and disappearance of the latter, point to the conclusion that one at least of their functions if not their only function, is the manufacture of antitoxins and immunizing bodies generally. As the germ-centers increase in number and activity in diseases which are certainly not bacterial in origin (hypothyroidism, hypopituitarism, hypoadrenalism, malnutrition and digestive diseases in children, etc.) they probably provide the organism with protective substances not only against bacterial toxins, but also with substances which neutralize the toxic products of abnormal metabolism.

When in the absence of essential vitamines the ductless glands are unable to supply a sufficiency of hormones, the pharyngeal lymph-ring hypertrophies. The most careful examination of lymph tissue removed from these cases reveals not the slightest microscopical evi-

(7) Am. Med., February, 1928.

dence of bacterial invasion. A clinical cure may often be obtained in this particular type of hypertrophy by the exhibition of iodin in minute doses. It seems, therefore, that in some cases tonsillar hypertrophy may be an attempt upon the part of the organism to make simple lymph organs perform the work of complex endocrine glands which are functionally incompetent. That one endocrine gland may attempt to replace another we do know. Thyroidectomy is followed by hypertrophy of the anterior lobe of the pituitary, a structure in intimate morphologic relationship with the pharyngeal tonsil. In this condition of compensatory hypertrophy following thyroidectomy the anterior lobe of the pituitary develops vesicles containing colloid material; but the attempt to do the work of the absent thyroid gland is a failure. The pituitary colloid contains no iodine, nor has it any of the physiologic or therapeutic properties of thyroid secretion.

If the lymphocytes do not go to the germ-centers for destruction there is no evidence whatever as to what becomes of them. Lymphocytes have no phagocytic action, their sole function being to fix toxins and produce antebodies.

In severe infections of an acute nature there occurs a characteristic change in the germ-centers. They become occupied by large cells with a clear nucleus which ingest and destroy both lymphocytes and bacteria. The so-called lymphoblasts are really phagocytes. A single phagocyte may contain the outlines of as many as fifteen lymphocytes. Massive infection is not needed to awaken a response in the pharyngeal lymph-ring.

Tonsillar hypertrophy constantly occurs at a time when the newly born human being is not yet immunized; at a time, that is, when infection is most dangerous. Once immunization is effected both the pharyngeal and faucial tonsils normally tend to regress and disappear.

Finally, it may be stated with some confidence that the theory of protection is not only the most reasonable

one in view of the pathologic findings and the hypertrophy which is the constant and immediate response to every variety of local or general toxemia, but also it is the only one which can be supported by clinical evidence.

The frequently encountered statement that the tonsils have no function because their removal is without effect is a loose generalization with antiquity as its only claim to respect. The author reports fourteen cases which support this contention.

Agranulocytic Angina: Report of Two Cases. J. J. Thompson[8] reports these fairly typical cases. The first patient was a woman aged 34. Her past history revealed depressive maniac psychosis during the late twenties. Sugar was found in the urine, increased in the blood, and recurrent attacks of secondary anemia had been noted.

When the author saw the case an ulcer had formed on the mucous surface of the upper lip, later ulcers on the tongue, right tonsil, right anterior pillar, gums of the upper maxilla and hard palate. Smears were negative for Vincent's organisms. The patient's general condition became poor, the temperature going to 104° F. The blood count showed: r. b. c. 3,900,000; hemoglobin, 72 per cent; w. b. c. 1,000; polymorphonuclear, 0; lymphocytes, 100 per cent. The patient died 18 days from the onset of the ulceration.

The second case occurred in a man aged 58. The patient first complained of slight soreness of the throat and chilly sensations. Examination showed the throat swollen and much inflamed. Both tonsils and uvula were covered with a dirty gray membrane. The cervical glands were much enlarged. The pulse was rapid and thready and 15,000 units antitoxin were given. Culture was negative for Klebs-Loeffler bacilli, but contained staphylococcus aureus in pure culture.

The blood count revealed: r. b. c., 3,800,000; hemo-

(8) Laryngoscope, June, 1928.

globin, 70 per cent; w. b. c., 900; polymorphonuclear, 0; lymphocytes, 100 per cent. The patient gradually became worse, cyanosis developed, temperature 105° F. The patient died while tracheotomy was being performed, just about two days after onset of soreness of the throat.

Agranulocytic Angina. L. K. Gundrum[9] reports another fatal case of this nature. The patient was a woman aged 58, who complained of fever and sore throat, accompanied by a rash of slightly raised red spots of dime size and covering parts of the body. Previously she had had two similar attacks with full recovery.

Examination showed slightly enlarged tonsils, the throat filled with stringy muco-pus and small grayish patches on the pharynx which were easily removable without bleeding. The blood count showed only 660 leukocytes (lymphocytes 82.5 per cent). The red count and hemoglobin were normal; the Wassermann negative. Bacteriologic examinations of the nose and throat were of no aid, and blood culture revealed nothing. On the sixth day following onset of the condition the patient died. At postmortem all viscera and bone marrow were essentially normal.

The number of cases recently reported make it probable that this condition has been overlooked in the past and is more common than would seem from the paucity of the reports. The diagnosis can be made certain only by the blood examination. A marked leukopenia with a relative increase of lymphocytes is always present. Other symptoms are variable. The only case in which treatment has been of any value is the one reported by Finnegan. He believes that the blood transfusion cured his patient. A 70 per cent alcohol gargle has been recommended on the theory that it is germicidal for *Bacillus pyocyaneus.*

This report is given with the hope that this malady

(9) Arch Int. Med., March, 1928.

may be recognized more frequently and that eventually a satisfactory treatment may be discovered.

Sensory and Trophic Disturbances of the Pharynx; Osteo-Arthritis Deformans of Cervical Vertebra. J. Terracol[1] deals with that perplexing group of patients who have a multitude of symptoms and complaints referred to the pharynx and tongue with little if any physical symptoms. The average consultant prefers to classify this unfortunate group of patients as hysterical, and thus they drift from one laryngologist to another. These patients are about or past middle age; they complain of symptoms localized either about the tongue or in the region of the tonsils and of difficulty in swallowing, a condition which disappears during eating; others have cancerphobia.

Examination is usually easy to perform. Enlargement of the lingual tonsils or varicosities at the base of the tongue may be found. The mucosa of the pharynx is usually atrophic, but the faucial tonsils may appear normal. On the whole, there is an abundance of symptoms with a scarcity of pathologic changes.

The author calls attention to the anatomy and pathology of the cervical vertebral column, and in particular to the osteo-arthritis that may occur. He reminds us of the work already done in other regions of the column for relief in conditions such as lumbago, localized paresis and dystrophies, and contends that the same condition may occur in the cervical column. He calls particular attention to the vertebral artery, which is almost entirely intra-osseous in this locality. The nervous elements, the glossopharyngeal, the vagus and the cervical sympathetic nerves, are in close relation to either the osseous column or its ligaments and muscles. The intervertebral foramen gives passage to the sympathetic fibers of the spinal nerves, spinal vessels and lymphatics; the author does not, however, stress

(1) Arch. internat. de laryng., November, 1927.

the pathologic processes of the foramen as the most important feature.

He groups the pathologic processes under the osseous and ligamentous lesions, which he believes are due to an "upset in the physiochemical equilibrium in the colloids constituting the interstitial plasma." The skeleton serves not only as a framework, but as a calcium reserve of the body, and at times this reserve is called on, resulting in rarefaction of the bone. Vasomotor disturbances and endocrine imbalance seem to play an important rôle in this condition. Calcification of the perivertebral structures results from edema of the connective tissue, which causes it to revert to the embryonal type; infiltration takes place and finally calcification.

The characteristic symptoms produced by changes in and about the cervical vertebrae are: (1) Pain in the pharynx due mostly to involvement of the vagus and cervical sympathetic nerves and pain at the base of the tongue caused by involvement of the glossopharyngeal nerve. (2) Motor disturbances, usually difficulty in swallowing, due to atrophy of the superior constrictor muscle, which is enervated by the glossopharyngeal nerve. (3) Sensory involvement, chiefly of the papilla at the base of the tongue which are supplied by the glossopharyngeal nerve. (4) Reflex pain because the pharyngeal reflex is under the control of the glossopharyngeal nerve. (5) Psychic symptoms.

The treatment is not entirely satisfactory. Local applications give only transitory if any results. Surgical measures are experimental. Physiotherapy, especially the roentgen-ray treatment and diathermia, give the best results.

Many of the symptoms referred to this region are in the nature of parathesias, and have no very definite clinical significance. As the author states, these patients usually attach serious importance to these symptoms and perhaps the most efficient treatment which the physician can carry out is to satisfy the patient that

there is nothing about the symptoms that has any serious significance, and, if the physician succeeds in dispelling that halo of anxiety which surrounds these symptoms, the patient is often able to forget them. To take the matter seriously and to carry out useless treatments is entirely the wrong attitude.—Ed.]

Treatment of Diphtheria Carriers. The only satisfactory form of treatment for the nose carrier tried during the investigation reported on by W. C. Harvey[2] was douching with a mildly alkaline nasal douche. Properly carried out, this yields excellent results.. Tonsillectomy yields very satisfactory results in carriers in whom the bacilli are confined to the throat. The ear carrier, happily uncommon, is very difficult to deal with, and does not respond readily to treatment. The treatment of diphtheria carriers should consist mainly in rectifying local abnormalities and pathologic conditions responsible for the carrier state. If this is done properly the coexistent abundant flora will be diminished, and the diphtheria bacillus will probably disappear also.

Diphtheria carriers should be treated as early during convalescence as is compatible with safety, the likelihood of diphtheria complications always being considered. The longer the bacilli are allowed to remain in the infected area, the more difficult does their removal become. In addition, apart from the loss of education to the children, the burdens which diphtheria carriers lay on the finances of the various public health bodies make the necessity for their early treatment and cure a very important consideration.

Hemorrhage from the Throat (Hemoptysis) Not of Pulmonary Origin. Hemoptysis from the lungs may be profuse and yet neither auscultation, percussion nor x-rays may be able to detect any physical sign of its source or origin. Hemoptysis may also occur in nearly every disease of the lungs and air passages, including

(2) Lancet, July 14, 1928.

such affections as emphysema, influenzal bronchitis, dilated bronchi, infection of the lungs by streptococci or the bacillus coli, syphilis of the lungs, localized pneumothorax, leakage from an aneurism, bronchial fluke (Paragonimus Westermanii), mitral disease, atheroma and high blood pressure.

The other sources of hemoptysis tabulated by St. Clair Thomson[3] are as follows: (1) Epistaxis, when blood flows backwards. (2) Adenoids. (3) Enlarged veins in the pharynx and around the base of the tongue, especially in gout, cirrhosis of the liver and influenza. (4) Suppuration and ulceration in connection with malignant disease, syphilis, peritonsillar abscess and (rarely) lupus or tuberculosis. (5) Spongy gums. (6) Multiple telangiectases. (7) Vicarious menstruation. (8) Trauma from accidental injury, the passage of instruments, rupture of veins by vomiting, or surgical operations. (9) Laryngeal hemorrhage, especially in the acute laryngitis of influenza. (10) From the trachea —varicose veins, congestion from pressure of enlarged thyroid gland or of an aneurism. (11) Various blood conditions—purpura, scurvy, pernicious anemia, leukemia, hemophilia, mercurial stomatitis, phosphorus poisoning, cirrhosis of the kidneys or liver, and certain acute fevers, especially enteric and yellow fever, hemorrhagic smallpox and influenza.

Gout, according to Semon and Watson Williams, is, comparatively speaking, the most fertile source of pharyngeal hemorrhage. Bleeding from the surface of the laryngeal mucous membrane must be distinguished from submucus hemorrhage. Blood clots may not be expelled but remain lodged in or near the vocal cords, so as to simulate the appearances of an angioma, carcinoma or a soft fibroma.

Symptoms. A slight clearing of the throat is often all that precedes the patient's discovery of blood in his mouth. If it comes in any quantity the expectoration

(3) Ann. Otol., Rhin. & Laryng., March, 1928.

is accompanied by the peculiarly sickening and depressing taste and smell of blood.

When no trace of a leaking vessel is visible, the case should be treated as one of early pulmonary tuberculosis, particularly if any suspicious indications are present—fatigue, anorexia, loss of weight, evening rise of temperature, anemia, neurasthenia, or a history of pleurisy.

In the author's experience as a laryngologist, hemoptysis is due to pulmonary tuberculosis in the great majority of cases. When it has been absolutely necessary to demonstrate this, he has done so by passing an endoscope and viewing the blood coming up from one or other bronchus. It is, indeed, quite rare for blood in any quantity to "come from the throat" except in well marked local lesions. It is easily, and not infrequently, produced by malingerers making suction on their gums.

Treatment.—Treatment depends on the discovery of the source of bleeding. The local bleeding may require adrenalin, hamamelis (Pond's Extract), catechu, or other astringents. The galvanocautery, if at hand, is often the speediest remedy. When large vessels are eaten into by cancer or abscess, it may be necessary to tie the external or common carotid. The administration of lactate of calcium will increase the coagulability of the blood. A hypodermic injection of morphia, gr. 1/6 to 1/4, with atropin, gr. 1/200 to 1/150, is one of the readiest, quickest and most reliable remedies.

In all cases the patient should be ensured complete rest and fresh, cool air. Alcohol and hot fluids should be forbidden. Solid food is not necessarily avoided. Excitement and fear must be guarded against. The sucking of ice, a weak spray of adrenalin, and small doses of opium may be indicated.

Infantile Nasopharynx and Its Constitutional Inferiority. Testut-Jacob described three types of infantile nasopharynx: the pointed arch, the rounded arch

and the low arch. K. Bernfeld[4] comes to the following conclusions:

1. The normal spacious epipharynx develops from the low infantile type.

2. If the growth of the epipharynx is retarded, an infantile type persists. This constitutes a constitutional inferiority.

3. The infantilism of the epipharynx manifests itself by the frequency of otonasopharyngeal inflammations, and by faulty ventilation of the upper respiratory tract. The proximity of the pathologically changed mucous membrane is of importance in regard to the duration and extent of diseases.

4. The constitutional inferiority of the persisting infantile nasopharynx is connected with other constitutionally inferior organs, for instance, with an infantile tube and a shallow tympanic cavity. Hereby the pneumatization of the temporal bone is influenced.

5. Digital exploration of the epipharynx reveals conditions in the three dimensions, namely, in the palatosphenoidal, the pharyngonasal, and the tubotubal diameters. The palatosphenoidal is shortened most frequently.

Diseases of the Larynx and Trachea

Contact Ulcer of the Larynx. Superficial erosions are not uncommon in chronic laryngitis, but there is a shallow ulcerative lesion that is deserving of a special designation and a particular recognition, because it is so frequently either overlooked altogether, in the milder cases, or mistaken for tuberculous or malignant disease in the case of larger lesions.

Definition. Contact ulcer is the name C. Jackson[5] has given to superficial ulceration occurring on one or both sides of the larynx posteriorly, the ulcerated sur-

(4) Ztschr. f. Hals-, Nasen-u. Ohrenh., Feb. 28, 1928.
(5) Ann. Otol., Rhin. & Laryng., March, 1928.

face coming in contact on phonation with that of its fellow of the opposite side, the latter being ulcerated or not, according to whether the ulcer is monolateral or bilateral.

Incidence.—The lesion is not a common one, inasmuch as the writer has seen only 127 cases in forty years.

Etiology.—The location and the evident contactual pressure seen in the mirror during phonation seem to indicate vocal abuse as the chief etiologic factor. This is corroborated by the fact that the condition is observed in persons using the voice excessively, and it is further corroborated by the observation that cure is usually impossible without vocal rest. Most of the cases have been seen in conjunction with chronic laryngitis, which would justify the inference that chronic inflammation of the laryngeal mucosa is also a cause, or at least that the ulcer and the chronic laryngitis are both dependent upon a cause common to both. Many of the patients complained of waking with choking, strangling cough at night, relieved after secretions were coughed out of the trachea. This suggested leakage into the larynx of oral secretions that should drain away downward into the esophagus. Such secretions would carry oral infection. This symptom was not present in all cases, however.

Pathology.—Histologic examinations in the various cases in which specimens have been taken to exclude malignant and tuberculous disease have all shown the usual histologic characteristics of chronic inflammation with ulceration. No specific histologic characteristics have been found so far. Bacteriologically the lesion has been found to be most frequently associated with Vincent's organisms, but in many typical cases these organisms were absent. While the ulcer is not deep, the vocal process of the arytenoid cartilage, because of its superficial position, is often involved and it becomes necrotic.

Symptomatology.—Hoarseness is present in most

cases, though it may be slight. Pain or at least discomfort in the larynx is usually present, though it may be overlooked by stolid individuals. In a few cases it was severe and radiated to the ear of the ulcerated side. The symptoms are usually marked by those of the accompanying chronic laryngitis. Choking and strangling at night from overflow of oral secretions into the larynx was present in a number of cases.

Diagnosis.—Exclusion of cancer and tuberculosis is called for in all cases. In many cases the extremely superficial character of the ulcer, rather an erosion or loss of epithelium than a true ulceration, taken together with the free mobility of the arytenoid, renders it advisable to await the result of a regime of absolute silence and omission of all irritant forms of treatment before taking a specimen. If, however, the ulcer persists after a month or two, biopsy is advisable. The utmost care and precision are required to avoid injury to the cricoarytenoid joint. When necessary for diagnosis, the excision usually has the added advantage of promoting cure of the ulceration. At biopsy the necrotic vocal process of the arytenoid cartilage is often found in the bed of the ulcer. No harm is done if a very small amount of the extreme tip of the process is removed, and, in fact, healing may follow.

Laryngoscopic Appearances.—In the mirror the ulcer is seen on edge, involving the almost perpendicular internal surface of the arytenoid cartilage. On inspiration the ulcer is exposed to view, but on phonation its internal surface is in contact with the internal surface of the opposite arytenoid eminence, which may or may not be ulcerated. Usually the thickened border of non-ulcerated mucosa at the upper margin of the lesion is seen, but the ulcerated surface is not. In some instances, the border forms a tiny roll rim around the ulcer, and the vocal process of the opposite arytenoid fits into the tiny bowl-like lesion. In some instances in the bottom of the bowl is found the denuded vocal

process of the ulcerated arytenoid. The usual site of the ulcer is the area in the neighborhood of the vocal process. (Fig. 58).

Prognosis.—Under mild, gentle, careful treatment, in almost all cases ultimate recovery has followed; but the progress has been rather slow in most instances. Energetic ill advised treatment is usually followed by edema,

Figure 58.

loss of cartilage, impairment of the arytenoid joint, and increased hoarseness. In one patient sent to us, extensive cauterization had caused perichondritis, with acute edematous stenosis, followed by chronic cicatricial stenosis. If the patient persists in vocal abuse, prognosis as to cure is unfavorable. In two such cases, cancer ultimately developed. In two other cases, in patients with pulmonary tuberculosis, the ulcers ultimately became tuberculous.

Treatment.—The fundamental requirement is absolute silence, the patient writing every word he has to say. Even whispering should be forbidden. All irritant applications, such as silver nitrate, or any other medicaments on a swab, are contraindicated. If after two months of silence have failed to cure the ulcer, it is better to excise it with great care and precision. Care should be taken to avoid damage to the cricoarytenoid joint and to avoid removal of a normal vocal process. If the vocal process is necrotic, removal of a small portion may promote healing. When there is a thickened rim of epithelialized mucosa around the ulcer, careful nipping off of this rim with small cupped forceps usu-

ally promotes healing in from the edges. After operation, residence at the seashore promotes healing. The ozone, chlorin and vapor of salt water, inspirated twenty-four hours out of the twenty-four, is of great benefit, not only to the ulceration, but also to the accompanying chronic laryngitis.

Laryngeal Tuberculosis: A Study of Five Hundred Patients Treated at the Maryland State Sanatorium from 1923 to 1928. E. A. Looper and L. V. Schneider[6] summarize their results as follows:

1. Tuberculosis of the larynx is secondary to tuberculosis of the lung. The condition is an evidence of a general lowered resistance.

2. Sputum is the most common cause of laryngeal infection, but organisms may enter by way of the lymph and the blood stream.

3. A thorough examination of the larynx should be made in all cases of tuberculosis, as soon as recognized.

4. Slight congestion, dryness and tickling sensations of the larynx should promptly receive attention, as such symptoms often indicate early invasion of the larynx.

5. Laryngeal tuberculosis occurs at every age of life but the majority of cases are found between 20 and 40 years of age, with males predominating.

6. Laryngeal tuberculosis has no relation to occupation.

7. Many cases can be prevented to a certain extent by the correction of pathologic conditions in the upper respiratory tract, such as deviated septum sinusitis, adenoids, hypertrophied turbinates and hypertrophied tonsils.

8. Nontuberculous laryngitis, colds, tonsillitis and excessive coughs in tuberculous patients should receive prompt attention, as conditions leading to superficial loss of epithelium open the way for infection by the sputum.

(6) J. A. M. A., Oct. 6, 1928.

9. The frequency of involvement of various parts of the larynx is directly proportional to exposure, irritation and functional activity.

10. Laryngeal tuberculosis has never been a promising field for medicinal therapy regardless of the method of treatment. Many different drugs have been used and many local applications have been tried, most of which have been abandoned, especially caustics and irritants.

11. The results of cautery treatments used sporadically in the Maryland Sanatorium until August, 1923, were so impressive and encouraging that the authors felt its continued and increasing use was the best form of treatment.

12. Of all the authors' patients with laryngeal lesions with moderate lung involvement treated by electrocautery, 65.5 per cent were improved and healed, and 26.5 per cent with far advanced lung involvement were improved and healed.

13. In the Maryland Sanatorium no "unimproved" patients were treated with cautery in the moderately advanced group.

14. Cautery treatment in many patients exercised a favorable influence on the lungs and on the general condition. No bad results were encountered.

15. Cauterization in all patients has been done under local anesthesia by the indirect method at monthly intervals.

16. Results obtained by electric cautery treatment indicate without doubt that tuberculosis of the larynx is curable, if started reasonably early.

17. In all suggestive cases the authors advise vocal rest or absolute silence. While active laryngeal tuberculosis does not have any tendency toward spontaneous healing, it is surprising with what rapidity some incipient cases with slight infiltration will clear up as the result of absolute silence. Therefore, regardless of

whatever method of treatment is added, silence is imperative in all cases.

18. The electric cautery seems likely to supersede all other procedures and enjoys at present the increasing recognition as the best method of treatment of laryngeal tuberculosis.

19. The revitalization of the tissues by induced hyperemia and the development of granulation tissue with formation of new blood vessels accounts for the good results obtained by the cautery.

20. Elevation of temperature (high degrees), marked asthenia and high blood pressure are contraindications in using the cautery, although in patients in whom serious symptoms (severe pain, difficulties of swallowing) demanded alleviation, the cautery was used to bring temporary relief.

21. In using the electrocautery, one thing should be particularly and strongly emphasized and that is the condition of the lungs. No laryngologist should undertake electrocautery treatment without coöperating with or being guarded by a clinician. Indiscriminate use of the cautery in unsuitable cases will do more harm than good and the method of treatment itself will be brought into disrepute.

The Symptomatology, Diagnosis and Treatment of Laryngeal Tuberculosis. According to F. R. Spencer[7] the importance of an early diagnosis of pulmonary tuberculosis and proper treatment can scarcely be emphasized too much. It is the best way to prevent laryngeal tuberculosis and offers the best opportunity for an early cure. The early diagnosis of laryngeal tuberculosis is next in importance. Having made the diagnosis, some form of rest for the larynx must be resorted to. The solar laryngoscope offers an excellent method of treatment. The cautery is often required for lesions which have resisted all other forms of treatment.

In using the cautery, after the cocainization is com-

(7) Ann. Otol., Rhin. & Laryng., March, 1928.

plete, the direct laryngoscope may be introduced, or the patient may be suspended with Lynch's suspension laryngoscope. Haslinger's directoscope is also very useful.

Rather long, sharp cautery points are best. These should be heated to a white heat and plunged deep into the lesion. If the point is red, the surface is seared without reaching the tubercle. Fibrosis is the purpose of cauterization, in order to destroy the tubercle ultimately, not total destruction at the time of the cauterization. The cautery electrode should be introduced into the lumen of the larynx and held near the tubercle. The current should be turned on, and the platinum point pushed into the tubercle as soon as the point is at a white heat. At a white heat it is easily used and withdrawn without adhering to the burned tissue. Two or three areas can usually be cauterized at one time, or even more, if the patient behaves well. If the patient's general and pulmonary condition will not permit much to be done, or if the patient is not coöperative it is far better to do too little rather than too much. Normal areas of the larynx should be carefully avoided.

The joints about the arytenoids should be shunned. Subsequent fibrosis with contraction will produce ankylosis and result in fixation of one or both cords.

Hemorrhage, either at the time or subsequently, may occur if the platinum point is used only red hot, because the eschar tends to adhere to the red point and leave a bleeding surface. The platinum point should be used at a white heat, because of the ease with which the point can be plunged into a tubercle and withdrawn, without detaching the eschar and without causing hemorrhage. Occasionally a secondary hemorrhage may occur when the slough separates on the tenth to the fourteenth day. This, however, is rarely severe.

Infection following the use of the cautery is extremely rare. This is doubtless due to the destruction

of infectious organisms by the cautery and the sealing of the lymph and blood vessels by the eschar.

Very little, if any, after care is required. Mild palliative remedies are useful for patients who demand that something more be done. Dropping a few c. c. of 1 per cent menthol in glymol into the larynx, from a laryngeal syringe, allays irritation. Narcotics are rarely required.

The reaction following the use of the electric cautery is, as a rule, not severe and patients usually recover rapidly during the subsequent ten to fourteen days. There is very little or no pain, either at the time or subsequently. Patients say the larynx feels thick or that it feels full. A feeling of suffocation could doubtless be produced by extensive cauterization at one time, but this must be avoided. Subglottic edema, especially in adults, is not likely following the judicious and careful use of this instrument. Rest in bed is best for a few days.

The cauterization can easily be repeated after a few weeks or months, depending upon the indications.

Mercurochrome 220 in Treatment of Laryngeal Tuberculosis. One of the most troublesome complications of pulmonary tuberculosis, to the physician as well as the patient, is a laryngeal infection. Just how much value one can attribute to the local treatment is obviously hard to determine in the individual case. The question of the general resistance must be considered; most important is complete voice rest.

For many years H. F. Gammon[8] has used all of the accepted local treatments at various times. During the last two years he has been using a 20 per cent solution of mercurochrome and the results of this treatment have been very gratifying. He treated his patients three times a week, and applied the dye on a swab, being sure of getting enough of the solution into the larynx, and the red color has persisted for a few days. The mucous

(8) M. J. & Record, Feb. 1, 1928.

membrane tension is apparently much greater for the dye than for the silver salts preparation.

No bad reaction has ever occurred from these treatments. The treatment has never been used in hopelessly advanced cases, or in terminal cases, but all patients have been advanced. One patient had marked edema of the arytenoids, epiglottis and vocal cords with ulceration of the right side of the epiglottis. After a few months' treatment all edema had subsided and ulceration stopped. Another patient had a general infection of pharynx and larynx, all of the mucous membrane showing infiltration, and the arytenoids, epiglottis and vocal cords were swollen. The condition is completely arrested now. A third patient had infiltration of the epiglottis and right vocal cord and arytenoid; this patient was treated with artificial pneumothorax in addition to the local laryngeal treatment. His laryngeal complication is cured. Still another patient had a very marked ulceration and infiltration of the left vocal cord. This after a few months' treatment showed no ulceration, but some thickening.

From his experience the author is of the opinion that mercurochrome 220 in a 20 per cent solution is a valuable agent in the treatment of pharyngeal and laryngeal infections complicating pulmonary tuberculosis.

Cancer of the Larynx. From his experience G. Tucker[9] believes that the earliest symptoms of cancer of the larynx are hoarseness and local discomfort. A persistence of these symptoms in an adult should place the patient under suspicion of cancer and he should be kept under observation of an expert laryngologist until a definite diagnosis is made. Mirror examination, while the most important method for study, is not conclusive, and should be supplemented by general examination, x-ray examination, serological studies, direct laryngoscopy, and biopsy, to exclude cancer definitely in a suspicious case.

(9) Surg. Gynec. & Obst., March, 1928.

Early diagnosis will permit a cure by laryngofissure in about 80 per cent of cases.

Biopsy by means of the direct laryngoscope should give a positive specimen in every case of cancer of the larynx. But if the specimen is inconclusive or negative, it should be repeated while any suspicion of cancer remains. In the hundreds of cases of cancer of the larynx in which a specimen has been removed for histological examination at the Bronchoscopic Clinic, evidence of metastasis as the result of biopsy has never been seen.

Laryngectomy, subhyoidpharyngotomy, and lateral pharyngotomy will cure a good percentage of the extensive intrinsic and extrinsic cases.

In inoperable cancer of the larynx tracheotomy and palliative radiation may be advisable.

Intrinsic Cancer of the Larynx. St. Clair Thomson[1] believes that impaired mobility of a vocal cord is not a necessary nor an early symptom of intrinsic cancer of the larynx. It is met with in less than half (about 44 per cent) of the cases presenting themselves as suitable for operation by laryngofissure.

It is more apt to develop in an embedded or infiltrating neoplasm than in a distinctly sessible or projecting growth. When present it is a valuable symptom in helping to distinguish a malignant from an innocent neoplasm. It is of little value, and may even be misleading, in diagnosing a malignant growth from a tuberculous or syphilitic deposit. Its absence is of good augury and hence the desirability of making an early diagnosis before it has developed. As regards prognosis, its presence is an unfavorable symptom. Its absence or presence is a valuable factor—in conjunction with other data—in determining the most suitable treatment.

Intrinsic Cancer of the Larynx, Operated on By Laryngofissure. By laryngofissure St. Clair Thomson[2]

(1) Lancet, Aug. 4, 1928.
(2) Brit. M. J., May 5, 1928.

means excising a mass which contains the whole cord, and includes the anterior commissure, part of the arytenoid, the ventricular band, and the subglottic area.

The present report is based on 70 cases of intrinsic cancer of the larynx. As to sex, 63 were males, 7 females. The age limits were from 35 to 80 years. The greatest incidence occurred in the sixth decade of life, thirty cases occurring then.

All of the 70 cases were operated on by laryngofissure, and of the total number, 34 are alive today, while 32 survived periods varying from 3 to 19 years. Two cases are too recent to be reported on as to the outcome following operation. Of the patients that died, 18 deaths were due to other causes, 7 due to malignant disease elsewhere but with no local recurrence, while 11 only succumbed to local recurrence.

The author believes that the evidence he has submitted justifies the conclusions he has formulated for some years. This latest and largest record satisfies him that if intrinsic cancer of the larynx is diagnosed early it is best operated on by laryngofissure—an operation which should be free from danger to life and followed by an adequate voice and a lasting cure. The only necessities for this consummation are early diagnosis and meticulous care in operative precaution and procedure. By educating the public to pay prompt regard to persistent hoarseness, and by teaching the profession to appreciate the niceties and necessities of early diagnosis, the number of laryngofissures and the proportion of lasting cures will steadily increase, while the need for laryngectomy will as progressively diminish.

In other regions of the body there may be better remedies than surgery can supply. In intrinsic cancer of the larynx other, simpler and surer, remedies no doubt will some day be discovered; but, at present, there is no better way than surgery and the laryngofissure route. By this one can secure results which have not

been surpassed in the treatment of cancer in any other internal region of the body.

Sarcoma of the Larynx. Of 9,554 carcinomas, 64 were of the larynx, and of 848 sarcomas, 1 was of the larynx (Gurlt's statistics). According to Hahn, Kraus and Schmidt, the incidence of sarcoma of the larynx is found to be 1 to from 17 to 25 carcinomas. M. Slobodnik[3] reports a case in point: A man, aged 68, who had suffered from hoarseness for two years, consulted a physician in the beginning of 1926. The condition followed an attack of grip. For half a year, the patient suffered from a slight, unproductive cough. A tumor the size of a large walnut was found in the larynx, beginning 1 cm. from the right margin of the aryepiglottic ligament and extending to the inner side of the thyroid cartilage. It covered the right portion of the larynx and extended beyond the middle line to the left, leaving a narrow slit for respiration. The growth was of rather hard consistence and was bluish red. Examination of a small section revealed a rhabdomyosarcoma. On Sept. 23, 1926, at the Virchow Hospital, the larynx was removed under local anesthesia. The surrounding glands were not swollen. Two months later, the wound had completely healed. Half a year later, the patient was free from complaint. The histologic picture of the tumor corresponded to that of a polymorphonuclear sarcoma.

In sarcoma of the larynx, pain is rare. There is extremely little tendency to ulceration. Most frequently, spindle cell sarcomas are found, originating in the anterior half of the larynx. Fibro-angio-adenosarcomas, chondrosarcomas, fibro-myosarcomas and lymphosarcomas are infrequent. Sometimes mixed tumors present themselves—for instance, there are spindle cells and round cells in the same tumor. Patients suffering from lymphosarcoma can live for a long time. Even after from seven to nineteen years, death occurs not in con-

(3) Ztschr. f. Hals-, Nasen-u. Ohrenh., Feb. 28, 1928.

sequence of tumor cachexia, but in consequence of suffocation or exhaustion caused by respiratory difficulties or pneumonia. Occupational overexertion does not predispose one to sarcoma of the larynx. Men are more frequently affected than women (in a ratio of about 20:1). The points of differentiation from carcinoma are: the duration, the rare and late disintegration, the absence of swollen lymphatic glands, the absence or insignificance of inflammation and infiltration in the surrounding tissue and the presence of frequently detached, nutlike tumors of various sizes.

Double Vocal Cords. A duplication of the vocal cords is a developmental disturbance, a so-called "sulcus glottideus (also 'sulcus vocalis') (Citelli)." Citelli could show this sulcus in 55 per cent of the larynxes he examined—comparatively more frequently in children than in adults. Citelli states that the sulcus glottideus is a regressive formation. It is found in the gorilla and other mammals; for instance, in the cat and pig. Citelli reported a case in which there was a real double formation of the vocal cords. Before Citelli, Salvi found that this sulcus is found mostly in human beings whose vocal cords' superior and inferior surfaces form an obtuse angle in a frontal cross-cut. It is claimed that this obtuse angle is found in the position of rest in anthropoids and the lower human races. It was found only ten times in the larynxes of fifty normal people, and but nine times in the larynxes of twelve people who had been executed. Citelli does not agree with Salvi concerning the importance of the obtuse angle. Alézias Oertel and Lautenschlaeger have reported cases of double vocal cords. The hoarse weak voice is explained by the incomplete closure of the glottis.

W. Berger[4] reports a case in point. A man, aged 23, a student of theology, had suffered from hoarseness since early youth. Before consulting Berger, he had been treated unsuccessfully for chronic laryngitis, psycho-

(4) Ztschr. f. Hals-, Nasen-u. Ohrenh., Feb. 28, 1928.

genic hoarseness and disturbance of mutation. Diphtheria and ulcerative processes could be excluded. The larynx was of medium size. The entrance and the posterior wall were reddened. The true vocal cords appeared slightly red and much swollen, with indistinct margins. The left was narrower than the right. On the surface of the right vocal cord, a blood vessel was noticed. A few millimeters under the true glottis a second glottis was observed. It was formed by two narrow, sharply defined, white cords which ran parallel with the true vocal cords. When the mucous membrane of the larynx was shrunk by cocaine epinephrin, the white cords were made plain in a width of from 2 to 3 mm. Examination of the voice showed the high pitch of the speaking voice to be "*d*," of the chest voice from "*B*" to "*e*," of the middle register from "*f*" to "*e'*" and of the falsetto voice from "*f'*" to "*e*^{2}" In the chest register, an incomplete closure of the vocal cords was noticed. A spindle-shaped slit remained open. The same was true for the falsetto voice, but it was not so pronounced. Stroboscopy did not show any movement of the white cords under the vocal cords.

Local treatment with menthol oil and ethyl-para-aminobenzoate, continued for several months, improved the chronic irritation of the larynx and pharynx. The inflammatory redness of the mucous membrane and the hypersecretion disappeared almost entirely. The vocal cords became paler, showed a more distinct outline and appeared narrower. Here the underlying duplications appeared to be of almost double width. The speaking voice was still too high, approximately from "*d*" to "*e*," but the various registers of the voice appeared somewhat lower: chest voice from "*F*" sharp to "*f*," middle register from "*g*" to "*d*" and falsetto voice from "*e'*" to "*g'* sharp" or "*a'*." The patient was told to take good care of his voice and to try to acquire a deeper register of speech. In this case, the existence of a bilateral prolapse of the ventriculi morgagni could

be excluded by probing and by examination of the movements of the vocal process.

An Operation for the Relief of Abductor Paralysis of the Larynx. After the preliminary incision, and the exposure of the trachea J. E. MacKenty[5] removes an oval section from the upper portion of the trachea

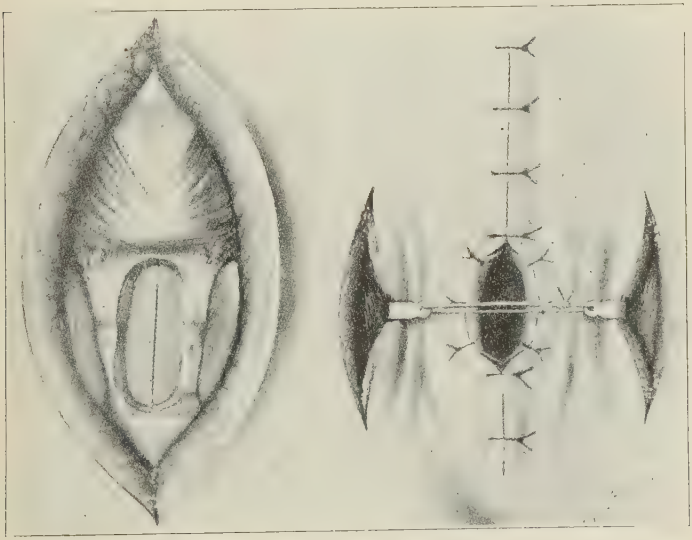

Fig. 59.—(left) Oval section taken from trachea. Mucous membrane of trachea split in the long axis of the opening.

Fig. 60.—(right) Tension hooks in place, causing puckering of the flaps for the relief of tension. Two sets may be used if necessary. The lines connecting the hooks would then cross at the two poles of the opening.

(Fig. 59). Following this the mucous membrane is everted over the cut edges of the tracheal rings and united with interrupted stitches to the skin margins, which latter have been thinned down by removal of the subcutaneous fat, pretracheal muscles, etc. Lateral incisions are made to reduce tension (Fig. 60). During the period of healing and contraction a small solid silver

(5) Arch. Otolaryng., July 1928.

obturator is worn to guard against closing of the opening (Fig. 61). The obturator may be cannulized if the laryngeal dyspnea is constant. The end-result appears as in Figure 62.

The author believes the operation may be used as an intermediate procedure between tracheotomy and ventriculocordectomy.

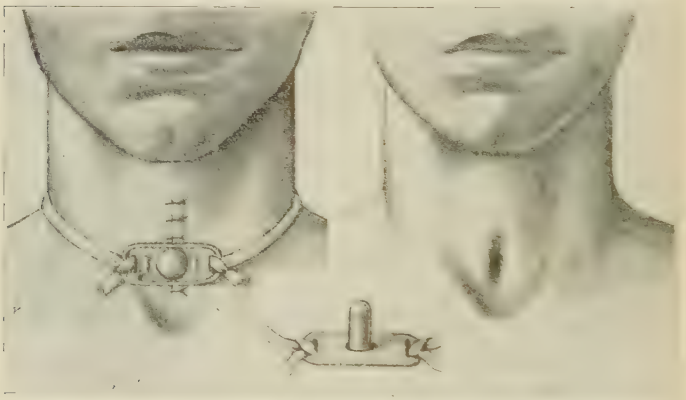

Fig. 61.—(left) Wound closed, with obturator in place.
Fig. 62.—(right) End-result. Opening should be small, from ½ to ¾ cm. in diameter.

Laryngeal and Phrenic Nerve Anastomoses. According to L. Colledge and C. Ballance[6], the proper operation to perform in man in cases of paralysis of a vocal cord is recurrent laryngeal-phrenic nerve end-to-side anastomosis. This was successful in the one case in which this operation was carried out. Independent of the cases in man in which by stab or gunshot wound, or during an operation, the recurrent laryngeal nerve has been divided, and in which an immediate anastomosis should be effected, the authors are of the opinion that if a vocal cord (or cords) has been paralyzed for three months without sign of improvement in the con-

(6) Brit. M. J., May 5, 1928.

dition, a recurrent laryngeal-phrenic nerve anastomosis should forthwith be carried out.

Acute Stenotic Laryngitis of Infectious Origin. Two cases of this type are reported by A. N. Champion[7].

Case 1.—T. S., a boy, age 22 months, had never been ill before. His father, mother, and two brothers were living and well. He was referred to the author by Drs. P. I. Nixon and Lucius Hill, with the history that three nights previously he had had a sudden attack of coughing and respiratory distress, associated with moderate fever. These symptoms gradually became worse. His temperature had varied from 100 to 103 degrees F. The cough was dry and "barking" in character but did not form a prominent part of the clinical picture. His voice was very husky. The dyspnea was so marked that the boy was unable to sleep at night. There was no definite history of a foreign body. The second night of the illness, another physician had given the patient ten thousand units of diphtheria antitoxin.

The boy was well developed and nourished. His respiratory rate was very rapid. There was marked inspiratory dyspnea and considerable retraction of the sternum and ribs, but no cyanosis. The pulse was full, the rate was 100 per minute and the temperature was 103° F. Although there was redness of the fauces and pharynx, neither a membrane nor exudate was visible. The cervical lymph glands were not palpable. Examination of the chest showed nothing but a marked inspiratory wheeze. Expiration was not labored. Otherwise the general physical examination was essentially negative.

Fluoroscopic study and roentgen-ray plates did not show a foreign body. The thymus was not enlarged. The diaphragmatic excursion was normal. Air appeared to be entering and leaving all parts of both lungs equally well.

Throat and laryngeal cultures were taken, which later

(7) Texas State J. Med., February, 1928.

were reported negative for *Bacillus diphtheriae*, but positive for *Staphylococci*, *Streptococci* and *Pneumococci*.

Direct examination with a Jackson laryngoscope showed marked redness and swelling of the arytenoid cartilages, aryepiglottic folds and ventricular bands. The epiglottis was not involved. The prominent ventricular bands almost obscured a view of the cords, which appeared redder than normal. The subglottic mucosa was fiery red and swollen, leaving only a slit-like aperture for breathing space. Neither a foreign body nor any membrane or exudate were seen.

Due to the physical findings in the larynx and the marked dyspnea, a tracheotomy was considered necessary. Accordingly, under local anesthesia, low tracheotomy was performed. Introduction of the cannula gave immediate and complete relief of the respiratory distress. Subsequently, there was considerable thick, tenacious secretion, which was removed by suction. The fever fell by lysis. The cannula was removed on the nineteenth day after the tracheotomy.

Case 2.—M. S., a twin brother of the patient in case 1, became ill four days after the beginning of his brother's illness. He developed sore throat, associated with moderate fever and a dry hacking cough. Two days later he began to have inspiratory dyspnea. The usual symptomatic treatment was given, but the dyspnea gradually became more marked. He pursued a similar clinical course to that of his brother, except that the temperature was of a lower grade. The physical findings were essentially the same as those in the foregoing case. Finally, seven days after the onset of illness, tracheotomy was necessary to relieve the respiratory distress. It gave immediate and complete relief of the dyspnea. The postoperative course was similar to that of the patient in case 1, except that greater difficulty was encountered in attempts to remove the cannula.

These two cases offer several points of interest. The

fact that twin brothers were affected indicates that the infection was a communicable one. The exact etiology is unknown, but it was probably a streptococcus infection. It is not clear why the infection should produce such marked changes in the larynx and very few changes elsewhere. Two possibilities suggest themselves. Either the causative organism had a predilection for that site or these patients had a hereditary weakness to infection of the laryngeal tissues.

The differential diagnosis presented an interesting problem. Laryngeal diphtheria, the early stage of measles or scarlet fever, bronchopneumonia, influenza, angioneurotic edema, bulbar palsy, postdiphtheritic paralysis, foreign body, and lastly an unknown infection, had to be considered.

The presence of laryngeal diphtheria was ruled out by the negative culture, the absence of any membrane in the pharynx or larynx, and the clinical course of the disease. Measles, scarlet fever, and bronchopneumonia were eliminated as possibilities by the absence of any skin eruption, the negative chest findings and the final course of the illness. Influenza is such an ill-defined disease entity that it was not definitely ruled out. Angioneurotic edema comes on suddenly, disappears as quickly and is not associated with fever or the marked inflammatory reaction seen in these cases. Bulbar palsy and postdiphtheria paralysis were not likely diagnoses because of the negative past history. Direct inspection of the larynx failed to reveal any paralysis. Roentgen-ray studies and laryngoscopic examination did not show a foreign body. The subsequent clinical history after tracheotomy was not that of a foreign body. Thus, the conclusion is reached that the condition was an acute inflammation of the larynx due to infection by an unknown organism.

Tracheotomy in Acute Laryngeal Obstruction. O. J. Dixon[8] believes that the operation of tracheotomy is

(8) J. Missouri M. A., February, 1928.

not properly taught in the medical schools. Too much emphasis is placed on complicated abdominal operations, while that of tracheotomy is either passed over as too minor to be discussed or too technical and hence belonging to the field of the specialist. As an interne the student frequently does not see the operation performed. The end-result is that he first faces the indication for tracheotomy when out in practice and it is no wonder that he approaches it with fear and trembling.

The author describes his technic of operation in detail. The most important part of the care of these cases is the after-care. No patient wearing a tracheotomy tube should be left alone. Whenever possible a specially trained nurse should be in attendance.

Tracheotomy is indicated in all acute cases of arrest of respiration with cyanosis, especially where the exact cause cannot be ascertained at the time.

Submucous Exenteration of the Larynx as a Therapeutic Measure in Definitive Stenosis. By the term definitive stenosis A. Sercer[9] means the condition remaining after the biologic reaction of the causative process has been completely terminated. It does not include acute or chronic inflammations, neoplasms or traumatism.

The stenosis is divided into four types: In (1), there is paralysis of the recurrent laryngeal with the vocal cords in the median position; in (2), the cords are in a median position, and there is ankylosis of the arycricoid articulation; in (3), cicatrization of the interior soft parts occurs and in (4), partial resorption or destruction of the cartilages causes collapse of the vocal box.

The technic of the operation is as follows. A local anesthetic of from 10 to 20 per cent of cocain is applied to the pharynx and larynx and a regional anesthetic of 0.5 per cent of procain is applied in the line of the incision and along the superior laryngeal nerves. A nar-

(9) Rev. de laryng., Sept. 15-20, 1927.

cotic with atropin may be employed. A soft rubber tube is inserted through the nose to the hypopharynx to aspirate saliva and blood from the field of operation.

An incision is made along the length of the thyroid cricoid and the first ring of the trachea. When the larynx has been opened, a tampon of cocain epinephrin is placed inside the larynx to complete the anesthesia. For extirpation of the vocal cords, an incision is made along the anterior wall of the larynx and along the vocal cords, a dissection is carried down to the perichondrium, and the cords are removed. The remaining musoca is brought together with fine catgut sutures. The author calls this his partial submucous exenteration of the larynx.

In the total exenteration, an incision is made along the ventricular bands, and the entire ventricle of Morgagni with its subordinate structures is dissected out. The cavity in both operations is packed with iodoform gauze. The larynx remains open, and the interior of the cavity is always under control until cicatrization is complete. When the surgeon is convinced that the patient is able to breathe freely, the opening is closed and the tracheotomy tube removed.

As a rule, the patients seek relief from the embarrassment of the tracheal cannula. Some authorities recommend cordectomy, while others condemn the procedure on account of the subsequent closure by cicatrization. The author contends that submucous exenteration and control through the external opening eliminates the complication.

The author reported two cases of laryngeal stenosis following typhoid and one following tuberculosis. In the first, three months following a tracheotomy for rapid suffocation, during abdominal typhoid fever, the patient presented himself for relief from the tracheotomy tube. The vocal cords and the arytenoids were in the median position and fixed. At first only one cord was extirpated, but later this was found unsatisfactory for free

respiration; so after some weeks the other cord was removed. This allowed free respiration, and the vocal function was fairly well taken care of by the ventricular bands.

The second case followed typhoid fever during which a tracheotomy had been performed. After seven years, the patient sought relief from the tracheal cannula. A total exenteration of the larynx was performed, but it was found that the pharynx was collapsed because of the partial resorption of the cricoid. In order to repair this defect, a graft from the sternum was used. An incision 7 cm. long was made on each side of the sternum, and a piece of the sternum, 6 cm. long, 2.5 cm. wide and from 3 to 4 mm. thick, was elevated. The skin from each side was tucked back under and sutured beneath the elevated bone, remaining intact by two pedicles above and below. The skin on each side of the sternum was drawn together beneath the elevated flap. Fifteen days later, the lower pedicle of the flap was severed, and at the end of another fifteen days, the flap was swung upward to close the defect in the larynx. Functional results were good. The patient breathed freely and comfortably at all times, and vocal function, which was relatively good, was carried on by the aryepiglottis.

The third patient had been treated for years for laryngeal tuberculosis. He was finally forced to wear a tracheotomy tube. A total exenteration was accomplished, and pathologic observations revealed recent tuberculous infiltrations in tissues cicatrized for a long time.

The author finds that patients usually seek relief from the embarrassment of the tracheal cannula. The operation effectually accomplishes this result, and at the same time gives the patient a better speaking voice than he had with the tracheal cannula in place.

Extensive Cut-Throat with Complete Laceration of Trachea and Esophagus. A man, aged 47, was cut in

the neck by glass from the windshield as a result of an automobile wreck. G. D. Scott[1] found the trachea and esophagus completely severed between the first and second tracheal rings. Both right and left carotid sheaths were exposed. The recurrent laryngeal nerves were undoubtedly severed, but were not identified.

Without anesthesia the author reunited the cut surfaces of the esophagus and trachea, using interrupted number 2 chromic catgut. Tracheotomy was done, and two cigaret drains inserted on each side of the trachea. The patient stood the operation well and was immediately able to swallow fluids.

Because of difficulty in swallowing gastrostomy was performed under local anesthesia the next day. However, the patient continued to take fluids per mouth. Six days after operation the patient removed both the tracheotomy and gastrostomy tubes. No ill effects followed and both wounds healed by primary intention.

Some difficulty in swallowing developed after several weeks but following the periodic use of bougies this has subsided. After several months the patient gradually developed a fairly good voice, but rapid respiration occurs with slight exertion.

X-ray Burns of the Throat: Report of Two Cases. In these cases reported by E. L. Posey[2] there was no open wound. The destruction was in the deeper parts. The two cases differed: the one patient's suffering was great and the other suffered very little after the first fifteen days following his injury. The severe sufferer had no external evidence of injury except a contraction of all parts. In the other the tissues of the neck were so badly swollen that the chin and breast were on the level with the neck.

The first case was a young lady, white, single, aged 22. Her health up to the time of this trouble had been good except for the ordinary diseases of childhood.

(1) J. A. M. A., March 3, 1928.
(2) South. M. J., February, 1928.

Fifteen months before she entered the hospital she was told by a physician that she had an exophthalmic goiter, and he advised x-ray for her ailment. She stated that she was given on an average of two treatments with the x-ray each week during these 15 months. She stated also that these treatments lasted from 10 to 15 min., and were administered at times by the physician, or his son, and when neither of them could give it, the colored maid gave it to her. This patient entered the hospital complaining of difficult swallowing and breathing, and severe coughing attacks when eating or swallowing. These symptoms had been present for some time and the patient had lost considerable weight. Her temperature was 101°; respiration and pulse 120; her suffering most excruciating.

Examination of the patient's throat revealed the following: the tongue, especially at the base, was red and had a glistening parched appearance. The arytenoids and epiglottis were very red and thick and had the appearance of cooked ham. The cords were red and swollen. The exterior of the neck showed a general contraction. Gargles, local applications and general supportive treatment were given for two weeks' time. The patient grew weaker each day, and the family physician advised that she be taken to another surgeon. This was done and after observing her for a day or two the latter decided to do a tracheotomy. By this time there was a general sloughing of the tissues inside the throat. There was a large opening from the trachea into the esophagus. The patient died a few days after the tracheal operation.

The second case was that of a white man, aged 45. The man entered the hospital with the following history: his general health was good. He had had no severe illness since childhood. He denied any venereal infection. During the preceding year he had had attacks of laryngitis and at times became quite hoarse. A few days before he contracted a cold and a short while

later developed an attack of laryngitis. This seemed to be the most severe attack the patient had experienced. Upon the advice of some friends he presented himself to the same physician who had treated patient No. 1, and was given x-ray treatment for his ailment. The night following this treatment he was unable to sleep because of difficult breathing. The next morning he was given another treatment of 12 or 15 min. exposure to the x-ray. This treatment aggravated the trouble and his breathing during the day and night became more difficult and labored. Shortly after the second treatment, his neck began to swell. The swelling began in and around the parotid glands and gradually met in the center of neck. The patient could not lie down. He fought for air until late in the afternoon of the next day when he came to the hospital.

Examination of the patient showed the following: the face was cyanosed, the extremities were cold and clammy. His neck was swollen to about four times its normal size. The swelling extended from the chin into the tissues below the clavicle and laterally to and including the parotid glands. (This swelling developed after the second x-ray treatment.) The mouth was red and filled with saliva. The epiglottis was markedly congested and the arytenoids were so swollen that nothing could be seen below them.

The urinary findings were negative. A smear and culture from the throat showed only staphylococci. A blood Wassermann was taken which later was returned negative. Blood count showed 12,000 leukocytes. The heart and lungs were negative. The patient was put in bed in the sitting posture, as he could not breathe lying down. Ice packs, gargles and opiates were given for twenty-four hours. Respiration by this time had become so difficult that the patient was almost completely exhausted and was dying from air hunger. The author decided to do a tracheotomy as the only thing that would save his life. The operation was very difficult

as the patient's neck was short and so much swelling was present. The hemorrhage was profuse, but after about 30 min. the author succeeded in getting into the trachea. The swelling was so great that a No. 8 tube would not extend from the exterior to the trachea. A piece of rubber tubing was used for 15 days. By this time the swelling had subsided sufficiently for a No. 8 tube to be introduced.

The man developed a bronchitis and for a few days it looked as though he had a pneumonia. This complication passed away, and with the subsiding of the swelling of the neck he became quite comfortable and began to recover. The neck remained swollen slightly for two months. For the first month it was necessary to change the inner tube very often. He left the hospital during his sixth week and was kept in bed at home for another two weeks. He suffered very little pain after the first three weeks. He has been seen twice each week since he first came and the findings in his throat are now as they were at first. He goes about doing his work of contractor, but is unable to breathe without the tube. He suffers no discomfort now, except a dry feeling and occasionally some slight pain in the throat. An oily solution relieves this. The author believes the patient is doomed to wear the tube the rest of his life.

Laryngeal Complications of Irradiation. From personal observations in six illustrative cases on the untoward effects of irradiation of the neck, L. Clerf[3] believes it is evident that these powerful therapeutic agents are potential sources of danger. Tissue sensitivity, individual susceptibility, cumulative effect and filtration are problems for the experienced radiologist.

Irradiation has no place in the treatment of recurring papillomas of the larynx in children. It is evident that the use of radium exerts no inhibitive influence or curative effect on papillomas. Its use should be condemned. Indiscriminate treatment of cancer of the larynx by

(3) Arch. Otolaryng., October, 1927.

irradiation should be discouraged. Patients with operable cases of cancer should not be treated except on the advice of the surgeon and radiologist.

Pulmonary Hemorrhage in Cases of Pulmonary Tuberculosis, Chronic Bronchiectasis and Mitral Stenosis. In reviewing the older literature on pulmonary disease, P. P. Vinson* is impressed with the significance accorded pulmonary hemorrhage in the diagnosis of pulmonary tuberculosis. Although this disease was not always diagnosed on the basis of pulmonary hemorrhage alone, such bleeding was usually attributed to a tuberculous focus until proved otherwise. Later, when the roentgen ray was used to aid in the examination of the lungs, it was observed that in many cases of pulmonary hemorrhage there was no demonstrable pulmonary lesion. It was, therefore, assumed in such cases that the hemorrhage was from a tuberculous focus near the hilum of the lung.

This conception of pulmonary hemorrhage prevailed until further aid in the diagnosis of pulmonary disease was afforded by bronchoscopy. Direct inspection of the trachea and bronchi revealed that many lesions other than those of tuberculosis cause bleeding from the lungs. Benign and malignant neoplasms, pulmonary abscess and foreign bodies are some of the less common lesions giving rise to pulmonary hemorrhage. More common causes are chronic bronchiectasis and chronic mitral endocarditis with stenosis.

The records of 100 patients suffering from active pulmonary tuberculosis have been reviewed and compared with those of an equal number of patients suffering from chronic bronchiectasis and also an equal number suffering from mitral stenosis, with dyspnea on exertion, in order to determine the relative incidence of pulmonary hemorrhage in these diseases. In none of the cases was there a lesion other than the essential one to account for the bleeding.

(*) Ann. Otol., Rhin. & Laryng., June, 1928.

Twenty-nine of the group of patients suffering from active pulmonary tuberculosis had had pulmonary bleeding during the course of the disease. In eleven cases the hemorrhages had been slight, in fifteen moderate, and in three severe. In none was the hemorrhage very severe. Hemorrhage did not follow exertion in any of the cases. There were multiple hemorrhages in eleven cases. It is of interest to note in connection with this small series that Heise, at the Trudeau Sanatorium, has observed pulmonary hemorrhage in 34 per cent of 1,062 cases of pulmonary tuberculosis previous to the patients' admission to the sanatorium.

In cases of chronic bronchiectasis is seen the highest percentage of pulmonary hemorrhage. It had occurred in 49 of this group of cases. In 20 the hemorrhage was slight, in 15 moderate, in 9 severe, and in 5 very severe. In 24 the hemorrhages were multiple. Hemorrhages followed exertion in 4 cases, in 2 of which it was precipitated at any time by undue physical strain.

Eighteen of the group of patients suffering from mitral stenosis, with dyspnea on exertion, had had pulmonary hemorrhage. The hemorrhage was described as slight, or "streaks of blood only" in 10 cases. In 5 it was moderate, in 2 it was severe, and in 1 very severe. Several hemorrhages occurred in the same patient in 12 cases. Hemorrhage followed exertion in 7.

While it is true that pulmonary tuberculosis is usually the cause of pulmonary hemorrhage, because of the greater frequency of the disease, yet its relative incidence is much greater in cases of chronic bronchiectasis, and the hemorrhage is more severe, more frequent and more often related to exertion.

Although pulmonary hemorrhage is absolutely and relatively less common in mitral stenosis than in pulmonary tuberculosis, it is common enough to warrant consideration in differential diagnosis.

Tertiary Syphilitic Lesions of the Trachea. Syphi-

litic involvement of the larynx and trachea, U. Virgili[4] states, occurs almost exclusively in the secondary or tertiary stage. Tracheal involvement is less common than laryngeal involvement, though often there are lesions in both organs. Diagnosis in the initial stage, and especially when other symptoms of syphilis in the organism are lacking, is extremely difficult without laryngoscopy or tracheoscopy. In syphilis of the trachea, tracheoscopy shows a roundish swelling on the tracheal wall, localized or diffuse, and presenting a smooth and reddish or yellowish surface, indicating incipient softening, at the protruding point. The ulceration has a crater-like shape, with an oily looking base and clean raised and reddish margins. In doubtful cases the therapeutic test should be applied.

The author follows Lacapére's method. Treatment is begun with intravenous injections of neoarsphenamin; if the lesions improve, the neoarsphenamin should alternate with bismuth until the lesions heal, and then bismuth should be used exclusively for the remaining period of treatment. The author reports a case of syphilitic lesions, with perforation of the trachea, in a man, aged 35, which responded promptly to intravenous injections of neoarsphenamin. After the fourth injection, the syphiloderma became cicatrized and the tracheal perforation was perceptibly narrowed. The perforation closed completely by the end of the first series of treatments and left no sign of stenosis.

Voice and Speech Disorders

The Voice in Singing and in Speaking. J. A. Glassburg[5] states that singing and speaking are closely associated, but they are different processes, and different training of the voice is necessary. They are two distinct mechanisms, but because they are carried on simultan-

(4) Gazz. d. Osp., May 20, 1928.
(5) Arch. Otolaryng., June, 1928.

eously, they have been erroneously considered as varieties of the same process. They differ in physiology, production and characteristics, both subjectively and objectively.

Objective.—The objective differences between singing and speaking are found in the range, pitch, duration and quality of the voice. Singing is usually rapid and overlapping or slurred, but this is not necessarily true of speaking. In singing, the voice ranges over two octaves or more. In speaking, it rarely covers even one octave. Singing is at a sustained pitch, whereas in speaking the pitch varies, changes and is short in duration.

Subjective.—Sound depends on the proper functioning of four mechanisms—the motor, the vibrator, the resonators and the articulators. The motor is the lungs that supply the breath. The vibrator is the vocal cords, the activity of which give pitch. The resonators are the cavities in the throat and mouth, the accessory nasal sinuses in the head and the body as a whole, all of which give quality. The articulators are the lips, the tongue, the uvula, the soft palate and the lower jaw. By their various movements, the articulators form obstructions to the clear passage of the breath and thus produce speech. In singing, the articulators perform a minor office, but in speaking they are of paramount importance.

Vocalization.—When the breath is pumped from the lungs, it is set in vibration by the vocal cords as it passes them. This is called vocalization. The vocalized breath produced may now become a vocal note or a speech sound, depending on how it is controlled. The vocalized breath as it issues from the larynx is broken up into two streams in the upper portion of the throat. This is accomplished by the uvula and the soft palate. One of these streams passes up through the nasopharynx into the resonant cavities of the head and produces head resonance. The other stream issues in the mouth, where it strikes against the palate and produces palatal res-

onance. In addition, the lower stream is utilized for speech, whereas the upper one is used for resonance only and the production of the sounds *n*, *m* and *ng*.

Vowel Production.—Speech is a function of the articulators, whereas pure sound is laryngeal in production. Singers who attempt to produce vowels by pure laryngeal exercise are practicting erroneously and harmfully. Though it is sometimes claimed that the vowel sounds are produced in the larynx, this is not true. The articulators are as important in the production of the vowels as they are in the production of the consonants. To convince oneself of this, one needs only to try to hum a vowel or produce a vowel with the tongue held down. The only success will be in the case of a broad *A*, because the natural position for the production of this sound is a tongue flat in the middle.

Training the Voice.—As singing and speaking are different processes, different training of the voice is required. A knowledge of the rudiments of singing is beneficial to the public speaker, but the singer needs the same training plus more, for he speaks when he sings. Speaking when one is singing should be an unconscious process. As soon as a speaker thinks of his articulation he is apt to throw the voice back, stiffen the tongue, contract the pharynx, strain the larynx and produce a husky or dead sound.

Physiology of the Voice.—In order properly to control articulation, it is necessary that the singer possess a knowledge of the physiology of the voice mechanism. The organs of speech are the lips, uvula, tongue, gums, palate and lower jaw. The first three participate actively, while the last three perform their functions passively, and consequently are often overlooked.

The Falsetto Voice. As indicated by its name, the falsetto voice is self-descriptive and is a false voice, characterized by a thin, high-pitched, piping quality. It belongs to the head tones and the resonating chambers associated are chiefly the accessory sinuses of the

head. Although simulating the undeveloped infantile or child's voice in its high-pitched quality, it lacks its strength and volume. Sometimes described as the eunuchoid voice, it also differs in volume and strength, and whereas the eunuch's voice is a natural one for him, the falsetto voice requires considerable effort and strength, with an adjustment of the larynx and associated muscular elements for its production.

Two entirely different theories seem to voice the ideas throughout the small amount of literature on the subject. The first is that by bringing the extrinsic muscles into play, lifting the anterior portion of the thyroid cartilage and depressing the posterior part, thus reducing the length of the larynx and changing the direction of the vocal vibrations. The tongue also would be depressed backwards, thus forcing the epiglottis against the posterior pharyngeal wall. The second theory is that the whole larynx is raised, the aryepiglotteal membranes or folds contract and in this manner lengthen the tube but decrease its calibre.

According to the rules of acoustics, as applied to resonating tubes, the pitch of the tone becomes higher as the size of the tube is reduced in width.

According to R. Ridpath[6], the production of ordinary phonatory effort or sound is brought about by the adductor muscles. Due to the stimuli received, the arytenoids and the cords as well, approach each other by the contractive action of the transversalis or interarytenoideus muscle. The cords are then made tense or stretched by the contraction of the fibres of the associated constrictor muscles, so that the interarytenoidian space almost disappears. The glottis is thus reduced to a narrow chink and this is the vision of the so-called medium range of speech. The cords are then thrown into vibrations by the blast of air against their edges from below upwards. In the human being, these vibrations are changed into articulated voice or speech by

(6) Laryngoscope, July, 1928.

the tongue, teeth, lips, hard palate, etc. Speech is modified into pleasant or unpleasant sounds by the resonators—the ventricles, pharyngeal wall, buccal cavities and the accessory sinuses of the head.

In ordinary speech we use about one-half an octave, whereas in song two-and-a-half or three octaves are used. It is known that shortening a vibrating cord results in a higher note. It is also a fact that if a vibrating cord is stretched, there is a higher note. Knowing these facts and knowing also that wonderfully constructed and flexible sound instrument—the larynx—one is not surprised when, through the action of the extrinsic muscles, particularly the cricothyroideus media in conjunction with the interarytenoideus, both these conditions are possible.

These are the movements and mechanical essentials for speech and song. Song is divided into its many divisions, according to the length of the vocal cords and the number of vibrations possible in the individual cases.

In the production of head or falsetto notes, the glottis is even more tightly closed behind. This posterior closure reaches its highest degree in the production of so-called ventriloquist's voice, in which the convulsive contraction of the adductors may even result in overlapping of the true vocal cords in their posterior half.

In conjunction with the changed poise of the larynx, there is a lowering or falling backward of the base of the tongue; this, in turn, forces the epiglottis backward, thus changing the shape of the resonators and the direction of the vibrations or sound.

In the chest voice, the vocal cords vibrate in their whole length. In the head voice, only part of the cord vibrates. To produce sounds an octave above, as required in the falsetto voice, necessitates still another change in the cords and whereas the posterior one-third of the cord vibrates in the head voice, the whole is still tense and close together throughout its entire length. In the production of this vocal anomaly there is vibra-

tion only of the posterior one-fourth of the cord, an overlapping of the cord at this point, an abnormal contraction of the interarytenoideus, so that the interarytenoidian space is practically eliminated. The extra tonicity of this muscle apparently lessening the contractibility of the other constrictor muscles, allowing a leakage anteriorly, this causing a forced action and suggesting a lack of muscular control, besides a disturbed balance in the respiratory tract.

Cleft Palate. An attempt is made by W. E. Wardill[7] to stress the importance of the formation of a pharyngeal valve in the sufferer from cleft palate, and it is believed to be impossible to restore normal speech unless this is first done. By the author's method, the pharyngeal wall is operated so as to produce a thickened cushion of tissue, thus bringing the pharyngeal wall closer to the palate. The operation is similar to pyloroplasty only it is done the reverse way. The method has been applied in eight cases (excluding one death). After this first procedure the author repairs the cleft. In the first two cases the attempt failed for the good reason that the technic of the procedure was not fully understood and the anatomical points of importance could not be anticipated. Practice of the method has assured increased speed and certainty in the attainment of the result, and it is felt that future cases will be approached with a confidence that, at any rate in a large percentage, a functional valve will be formed. That this result cannot fail to reflect itself in improved speech must be obvious to all who have made a study of the subject.

In the discussion of the results of the procedure recommended, little mention has been made of the effects upon speech because of the short period of time which has elapsed since the earliest of the cases was submitted to operation. But there is abundant evidence, even at this early date, to make one sanguine of the issue. No claim is made to have found the solution of the problem

(7) Brit. J. Surg., July, 1928.

in cleft palate, because all the surgeon can do it to provide a physiological palatal mechanism as a basis for the subsequent acquisition of speech. Perseverance, ambition, and shame are not yet included in the list of conditions amenable to plastic surgery, and so much depends on these abstract qualities, together with the intelligent guidance of a good teacher, that any claim to infallibility would be a claim to the impossible.

Harelip and Cleft Palate. This article by W. B. Davis[8] is based on a study of 425 cases of harelip and cleft palate, about half of which were treated on DaCosta's service. The deformities represented were as follows:

	Cases	Per cent
Unilateral harelip, left	34	8
Unilateral harelip, right	21	4.94
Bilateral harelip	13	3.05
Median harelip	2	0.47
Unilateral harelip and cleft palate, left	132	31.05
Unilateral harelip and cleft palate, right	26	6.11
Unilateral harelip and bilateral cleft palate	8	1.88
Bilateral harelip and unilateral cleft palate	6	1.41
Bilateral harelip and bilateral cleft palate	55	12.94
Unilateral cleft palate extending into hard palate without lip deformity	9	2.11
Bilateral cleft palate extending into hard palate without lip deformity	85	20
Cleft palate involving soft palate only	34	8

Fifty-six per cent of the patients were males and 6 per cent were Hebrews. Sixty-three per cent were under seven months of age. There was only one negro.

A positive family history was obtained in 57 per cent of the cases. In 18 instances the absence of lateral incisor teeth in one generation was followed by a cleft lip or palate in the next generation. Other congenital defects were found in 27 cases.

In 9 cases of double cleft palate the palatal processes were so small that operation was not done. Operation was performed in 393 cases. The mortality was 2 per cent.

Harelip deformities should be corrected between the

(8) Ann. Surg., April, 1928.

tenth day and third month of life. In the author's cases, the incisions are outlined by the Thompson method. In single cleft lip and palate, the alveolus and lip should be repaired at the same time and before the fourth month. The alveolus is repaired by fracturing the outer plate of the premaxilla with a chisel, forcing it into occlusion with the other half, and fixing it in place with a wire suture. When the cleft is narrow and when the infant is very young, this procedure may not be necessary.

In cases of bilateral cleft palate, an approximately normal position of the premaxilla may be obtained by excising a V-shaped section from the septum, to allow postero-inferior rotation, or by splitting the vomer anteroposteriorly to allow bulging on both sides when the premaxilla is pushed back.

Cleft palate is best corrected between the ninth and twentieth months of life. Clefts extending at least one-half through the hard palate should be operated upon in two stages from five to eight days apart. As a rule, the author has brought the rudimentary horizontal processes of the maxillæ and palate bones over with the soft tissues, using bone from the side not attached to the nasal septum in unilateral cases and from both sides in bilateral cases. The flaps are approximated and held in the midline by means of gauze tape placed around them and iodoform gauze packs introduced into the lateral incisions. At the second operation, wire sutures are placed anteriorly, the edges are trimmed, and closure is completed, silk being used posteriorly. Tapes are then re-applied.

The tapes and sutures are removed at intervals up to fifteen days. In cases in which the bone is lost and union does not occur, secondary repair is more difficult, but when the described technic is employed the bone is very seldom lost. It is best to complete all stages of the operation before the child is two years old.

Eight illustrative cases are reported.

Teaching Bronchoscopy and Esophagoscopy. In his usual effective manner, C. Jackson[9] emphasizes the following points:

1. Systematic instruction in direct laryngoscopy, bronchoscopy, esophagoscopy and gatroscopy is essential for the safe performance of these procedures.

2. If bronchoscopy for diagnosis and treatment of pulmonary disease is to have the full measure of application that its life-saving usefulness merits, those who perform this operation must be taught and drilled so thoroughly that danger is eliminated and the duration of the procedure and the discomfort to the patient are minimized.

3. Preliminary training on the rubber tube manikin should be the first stage of the instruction.

4. The cadaver should be used to teach: (*a*) seriatim identification of landmarks; (*b*) endoscopic anatomy; (*c*) the position of the patient, contrasting faulty with correct positions; (*d*) dangers and how to avoid them; and (*e*) for the purpose of drill, the pupil being trained in all the procedures of introduction of instruments, use of forceps, etc., until a condition of "nerve-cell habit" is created. Work on the cadaver should also include practice in the solution of all the important mechanical problems of the disimpaction of foreign bodies, disentangling, version and conversion of unfavorable into favorable presentations.

5. Practice on the dog should be thoroughly carried out for the study of the normal color, form and movements of the larynx, the tracheobronchial tree, the hypopharynx, the esophagus and the stomach. Practice in the manipulations of foreign bodies should include all the recognized problems and their solutions.

6. Clinical work should not be attempted until after the pupil has had at least sixty hours of preliminary

(9) Arch. Otolaryng., January, 1928.

training on the rubber tube, cadaver and dog. One hundred hours of preliminary training are desirable.

The Topography of the Mouth and Throat from the Point of View of the Direct Endoscopy of the Respiratory and Digestive Organs. In direct endoscopy, a displacement of the organs of the mouth and throat occurs. The angle maxilla-hyoidbone-larynx must be straightened to an obtuse angle. The literature does not mention the position of the cervical spinal column. F. Hasslinger[1] investigated the effect of dorsal flexion of the head: (*a*) in the normal position of the cervical spinal column, (*b*) when it is bent backward and (*c*) when it is bent forward. The head can be bent backward for 30 degrees in the average case. Orthodiagraphic measurements show that in this position the distance cranial base-hyoidbone-sternum is increased to about 3 to 5 cm.; thereby the distance between the cranial base and the hyoidbone is increased from 1 to 2 cm., and the distance between the hyoidbone and sternum about from 2 to 3 cm. Besides, the large horns of the hyoidbone, which lie about in the plane of the posterior wall of the pharynx when the head is in a normal position, shift to a position behind this plane. Also, the epiglottis and the anterior wall of the larynx are drawn backward and approach the spinal column. Only by strong pressure can the mouth and throat be displaced forward. The author cites the disadvantages of this position for direct laryngoscopy and for esophagoscopy. The necessity for employing this position presents itself only when the tube has passed the cricoid cartilage and when it should enter the parts of the esophagus at the spot where the esophagus is bent forward, under the narrow portion of the aorta. The extreme dorsal flexion is decried generally, and only a slight bending back of the head is recommended.

The investigations of the author led to the conclusion that the maximal bending of the head backward and,

(1) Ztschr. f. Hals-, Nasen-u. Ohrenh., 19:42, 1927.

simultaneously, the pronounced bending of the cervical spinal column forward, must be considered the most favorable position in which the tube can be introduced into the larynx, trachea and esophagus. It does not make any difference whether the patient is examined in a sitting position or when he is lying down. In the latter position, the head and cervical spinal column should reach beyond the border of the table. The right hand of the assistant lifts the occiput so that it lies higher than the table. The left hand bends the head maximally backward; hereby, the cervical spinal column is bent forward. In order to fix the upper portion of the patient's body, the assistant exercises a slight pressure on the chest with his left elbow. It was frequently observed that the relaxation of the muscles of the neck was more complete when the patient felt a solid support under his head. The natural movements of the head could not be followed if the existing supports for the head were used; therefore, the author devised a new support to be used in the position set forth.

New Head-Rest for Endoscopic Examination. The head-rest which H. M. Goodyear[2] presents was designed by Hasslinger in Hajeck's Clinic in Vienna. While working in this clinic, the author was much impressed with the advantages of this ingenious device and brought one home for further study. When one depends on an assistant to hold the head in a uniform position by use of the hand alone, the head is often unsteady and the soft parts of the neck unrelaxed. Again, it may be impossible to obtain the services of a trained assistant, in which case the operator may bring the head in any desired position for a prolonged period by means of the movable head-rest.

With this new device, it is not only possible to retain the head and cervical spine in marked dorsoflexion, but the elevation can be changed to any desired position by

(2) Arch. Otolaryngol., August, 1928.

means of a small wheel which locks automatically (Fig. 63).

The head-rest, being fixed on a curved arm, describes an arc following the natural movements of the head, which is a distinct advantage over an elevation made in the direct vertical plane. All lateral movements are easily obtained, as the body of the entire mechanism swings free on a vertical axis.

Fig. 63.—Head-rest in two positions.

A Bullet in the Lung. C. Jackson[3] reports a new method of using magnetism in foreign body work. On x-ray a soldier was found to have a bullet in the left upper lobe of the lung. He had no wound of entrance in the chest wall, but had received a bullet fracture of the lower jaw. Presumably the bullet had spent itself on penetrating into the fauces, whence it was inspirated into the lung.

Attempts at removal showed that the bullet was free to move about in a cavity, but that the introduction of the forceps caused it to fly up "around the corner" and so out of reach. After several attempts the author used a large magnet on the outside of the chest. This kept

(3) J. A. M. A., April 21, 1928.

the bullet down, allowing proper grasping of the object. It was then easily removed (Fig. 64).

The author states that the bullet could not have been withdrawn through the mouth by any form of magnet, because no magnet practicable for such use could have sufficient power to withdraw the bullet through the tightly strictured fibrous passage. Though the bullet

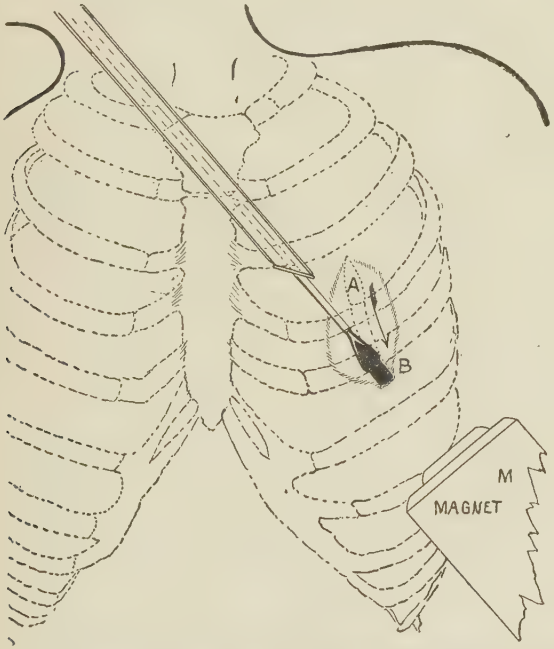

Fig. 64.—Schematic illustration of magnetic fixation aiding bronchoscopic removal of a bullet that was "up round the corner" *A* out of reach in the left upper lobe bronchus. Application of the Sweet eye magnet *M* to the external wall of the chest pulled the bullet down from position *A* to position *B* and fixed it there until it could be firmly grasped with bronchoscopic forceps, with which the bullet was removed through the mouth.

was free to move in the abscess cavity, a few pounds of tractive effort were necessary to withdraw it through the fistula.

For a bullet to be influenced by magnetism it is ne-

cessary that it be composed in part at least of cobalt, nickel, iron or steel, and it must be of magnetic forms of these metals. Certain alloys of nickel and steel are not magnetic. Fortunately, in this case the bullet was highly magnetic.

In the case of a bullet or any other foreign body of similar size anywhere in the lungs, except in one of the upper lobes and except for the special purpose herein indicated, a magnet would be a time-wasting, cumbrous impediment, and probably would be unsuccessful. Bronchoscopic removal by direct vision in the regular way leaves nothing to be desired as to promptness, facility, efficiency or safety.

The Fluroscopic Removal of Metallic Foreign Bodies. D. C. Smyth[4] believes that fluoroscopy, using the two-plane fluoroscope, should be regarded as a first aid and not as a last resort in the removal of opaque foreign bodies from the bronchial tree. It should be at hand in all cases where the foreign body has been in the lung for a long period, making the chances of seeing it by direct vision or of feeling it, very small.

It should be used after one attempt at removal by direct vision has failed, provided the attempt has been made by a competent bronchoscopist, and everything possible has been done at the first trial. The mortality is not appreciably raised by this method. The anesthetic should be selected according to the conditions to combat. Fluoroscopic removal is preferable to removal of the foreign body by tactile sensation alone.

Under general anesthesia the excursion of the foreign body can be controlled by an assistant fixing the diaphragm on the side of the intruder. This is of very great assistance in accurate grasping of the intruder. This point is new.

Provided no acute condition is present, the duration of bronchoscopy in adults is of secondary importance, the most important thing being gentleness, which means

(4) New England J. Med., June 14, 1928.

lack of any trauma. In other words, the bronchoscopist should not strive primarily for speed, but should rather exercise the greatest patience and his manipulations should be the most gentle possible. This conclusion is not based on the series of cases reported in this paper alone but rather the result of observations in quite a considerable number of foreign bodies in the air passages of fairly long duration.

An expert fluoroscopist is necessary and should share fifty-fifty any success achieved by the operator.

Pulmonary Abscess Following Tonsillectomy. According to A. Ochsner and W. Nesbit[5], Fetterolf and Fox have shown that following tonsillectomy there is microscopic evidence of trauma. Following an infection of the tonsillectomy wound with virulent organisms, evidence of infection and thromboses of the peritonsillar vessels were demonstrated. These observations have shown that thromboses do not occur in the region of the tonsillar wound, except when virulent organisms are introduced into the tissue of the tonsillar fossa; moreover, Fetterolf and Fox have not demonstrated that should these thromboses occur, they would become emboli and pass into the pulmonary vessels.

Up to the time of the experimental work of Cutler, Holman, Schlueter and others, the aspiration theory was accepted by most observers. The results obtained by introducing virulent organisms into the tracheobronchial tree have been largely disappointing, however. Cutler, Schlueter and Holman, Aschner, and others have been unsuccessful in attempting to produce a pulmonary abscess in dogs in this manner. In fact, all attempts have been unsuccessful, except those of Smith, who was able to produce pulmonary abscess in animals by introducing into the trachea material obtained from the teeth of persons with pyorrhea. The organisms introduced were *Spirilla,* fusiform bacilli and cocci. Of the guinea-pigs so treated, 20 per cent developed pulmonary abscesses.

(5) Arch. Otolaryng., October, 1927.

Smith's work has shown that abscess of the lung may be produced experimentally under proper conditions, following the introduction of bacteria into the tracheobronchial tree.

One of the most convincing proofs in favor of the aspiration theory is the invariable existence of a communication between the abscess cavity and a bronchus.

From a pathologic study of ten cases of pulmonary abscess following tonsillectomy, Aschner has shown that the abscess cavity is a direct continuation of a bronchus, and that the cavity is lined with epithelium, which is continuous with that of the bronchus. "The presence of the epithelial lining and the gross pathology indicate without doubt that the usual post-tonsillectomy lung infection begins as a localized lesion in a bronchus."

Meyerson adds further clinical evidence that these abscesses originate in a bronchus. Questionnaires sent to thoracic surgeons and others interested in this problem resulted in the report that none of them had ever seen a case of pulmonary abscess following tonsillectomy which did not communicate with a bronchus, with the single exception of Tewksbury.

From all this mass of evidence, one must admit that the most common mode of infection is by aspiration into the tracheobronchial tree when the protective reflexes are abolished. Under general anesthesia these reflexes are abolished; under local, they are supposedly not abolished. For this reason, it has been difficult in the past to account for the large percentage of pulmonary abscesses following tonsillectomy under local anesthesia.

As Cutler, who is the most ardent advocate of the embolic theory, states: "Lung abscess is in that sense embolic and not aspiration. As proof of this, I state the fact that cases have been reported where lung abscess has occurred following tonsillectomy under local anesthesia."

The authors believe that their observations in over 600 cases supply the missing link of evidence in support

of the aspiration theory. The mere application of a cocain solution to the anterior pillars of the pharynx abolishes certain protective reflexes of the respiratory tract resulting in aspiration.

Also, following the peritonsillar infiltration with procain, iodized oil taken into the pharynx passed entirely into the tracheobronchial tree in a series of five tonsil cases. This observation removes the one objection to the aspiration theory of abscess of the lung following tonsillectomy.

Lung Abscess Following Tonsillectomy from the Standpoint of the Bronchoscopist. L. H. Clerf[6] feels that with the increasing number of reported cases of lung abscess complicating tonsillectomy, it behooves every laryngologist to study his patients carefully before operation and to employ all possible prophylactic measures.

The development of pulmonary symptoms following tonsillectomy should immediately raise the question of impending lung abscess. No patient on whom tonsillectomy has been performed should be discharged from observation until three or four weeks have elapsed.

In a postoperative lung complication, no examination should be considered complete unless a roentgenologic study has been made.

Bronchoscopic aspiration, carried out by an experienced bronchoscopist, on the advice of the internist, roentgenologist, and surgeon, and in conjunction with such medical treatment as may be recommended by the internist, constitutes one of the most valuable methods of treatment.

No patient with an incipient abscess of the lung has had the full benefits afforded by medical and surgical skill.

Aspiration of Blood Into the Larynx and Trachea During Tonsillectomy Under Local Anesthesia: A Contribution to the Etiology of Lung Abscess. In the

(6) Atlantic M. J., September, 1928.

light of the recent experimental and clinical evidence, a much discussed question again presents itself. S. Iglauer[7] asks whether posttonsillectomy abscess occurs chiefly as a result of septic embolism and infarction, or does aspiration play the chief rôle in its production?

The embolic theory rests in the main upon the postoperative condition of the tonsillectomy wound and upon the successful experimental production of lung abscess in the dog by the introduction of an infected artificial embolus. The posttonsillectomy wound situated in a septic field naturally contains thrombosed veins which are more or less infected. For the most part these veins are of small caliber, and very rarely is there any evidence of extension of the thrombotic process into the larger adjacent veins of the neck. If septic embolism from the tonsil bed were of frequent occurrence, one would expect numerous small emboli to be set free, with multiple secondary abscesses, not only in the lungs, but also in the course of the systemic circulation. In other words, one would expect a clinical picture of pyemia rather than a massive single lung abscess. Clinical and postmortem evidence of a generalized pyemia after tonsillectomy is very scant, the typical case being reported by Hedblom being one of the few found in the literature. The successful experimental production of a single lung abscess after the introduction of a large infected embolus into the jugular vein does not exactly reproduce the posttonsillectomy conditions. The experiment simulates rather closely the pathology embolism after sigmoid sinus thrombosis in which septic emboli are conveyed through the jugular vein, not only to the lungs, but also to distant parts of the body. The experiment undoubtedly explains most of the pulmonary complications in laparotomy performed under local anesthesia.

It cannot be denied that embolism from the tonsillec-

(7) Ann. Otol., Rhin. & Laryng., March, 1928.

tomy wound is possible, but in all probability it is of very infrequent occurrence.

The early experiments of Hoelscher and the recent work of Lemon show conclusively that buccal contents are usually inspired under general anesthesia, and were it not for the protective mechanism of the tracheobronchial tree lung abscess would be more frequently observed. The infecting agent is also important, as pointed out by Lord, who stated "that the incidence of postoperative pneumonia is five times greater in midwinter than in midsummer, probably due to the prevalence during the winter months of more virulent types of organisms in the respiratory tract and their aspiration into the lung." It is difficult to explain the seasonal incidence on any other theory.

Bronchoscopy by different observers on a total of 400 patients has shown the presence of aspirated blood in from 40 to 78 per cent. of all tonsillectomies performed under general anesthesia. Should this aspirated blood become infected and remain in the bronchi for a sufficient length of time, it seems reasonable to suppose that lung abscess might ensue.

Th author has demonstrated that aspiration of blood also occurs in tonsillectomy, performed under local anesthesia, in about 38 per cent of all cases. In these cases the quantity aspirated and the depth of penetration is usually less than that observed under general anesthesia. This would help to explain the greater incidence of lung abscess in tonsillectomy under general anesthesia.

The clinical experiments of Ochsner and Nesbit, as well as the author's modification of these experiments, show that under local anesthesia for tonsillectomy lipiodol may enter the smaller bronchi. The successful experimental production of lung abscess by the endobronchial introduction of pyorrheal material, or minced tonsil tissue as carried out by Smith, Allen, and Crowe and Scarff, would seem to remove all doubt as to the as-

piratory origin of most posttonsillectomy lung abscesses.

Thus, both clinical and experimental evidence indicate that aspiration of infective material is responsible for the majority of postoperative lung abscesses.

Tracheobronchial Tree in Children. H. H. Vail[8] reviews the reports in the literature with reference to blood aspirated during tonsillectomy under ether anesthesia.

In his first series of 100 cases in which bronchoscopy was performed after operations on the tonsils and adenoids, Myerson found that 79 patients had aspirated blood into the tracheobronchial tree. In his second series of 100 cases, he found that 76 patients had aspirated blood. Louis Daily and Ray K. Daily, in 100 cases, found that 78 patients aspirated blood. In a series of 100 cases at the Cincinnati General Hospital 62 patients aspirated blood. Though the figures in this institution are slightly lower than those of the other observers, they are sufficiently high to make one think about the importance of overcoming the aspiration of blood into the tracheobronchial tree during operations on the tonsils and adenoids under ether anesthesia.

Myerson followed up the cases in his first series; one patient died of bronchial pneumonia. It has been impossible to follow up the patients from the Cincinnati General Hospital well enough to make any definite report about the sequelae of operation.

Postoperative Atelectasis: Bronchoscopic Observations on Massive Collapse of the Lungs. G. Tucker[9] summarizes his views on this topic as follows:

1. Bronchoscopic observations so far recorded indicate, as Dr. Jackson has observed, that postoperative atelectasis is similar to atelectasis due to foreign body.

2. The mechanism of the production of postoperative atelectasis is somewhat different from that of atelectasis due to foreign body. In foreign body atelectasis the

(8) Arch. Otolaryng., July, 1928.
(9) Ann. Otol., Rhin. & Laryng., June, 1928.

cough mechanism is not usually at fault and the block is only at the point where complete obstruction occurs in the bronchus. In postoperative atelectasis there is interference with the cough mechanism in the affected portion of the lung and the obstructive secretion, which is in reality a foreign body, extends from the point of complete block into all the smaller bronchi and their branches in the portion of lung distal to this point. From the quotations and comments in the literature on the report of the first case of massive collapse studied bronchoscopically it would seem to be the general impression that the secretion occurred as isolated plugs or crusts throughout the atelectatic area. This was not the case. The bronchoscopic findings indicated that the secretions extended peripherally into the smaller bronchi, forming as it were, a cast of that portion of the tracheobronchial tree.

3. The bronchi remain dilated in the affected portion of lung in postoperative atelectasis, due to the atmospheric pressure through the lumen of the tracheobronchial tree. The air is absorbed from the alveoli and the portion of the tracheobronchial tree containing the secretion is pushed toward the pleura overlying the atelectatic area of lung.

4. Because of the extension of secretion into the smaller bronchi in postoperative atelectasis the obstructive secretion (foreign body) cannot be completely removed as can the usual foreign body. Recovery is therefore not so rapid as in obstructive atelectasis due to a foreign body where the obstruction can be removed entirely.

5. The impairment of the cough mechanism, with the variations in the character of the secretions at different stages in the progress of postoperative atelectasis offer a possible explanation for the variations in bronchoscopic findings.

6. There are possibly many factors not definitely determined in the mechanism of the production of post-

operative atelectasis of the lung. In order to obtain all possible information it is suggested that a detailed report of all bronchoscopic observations be made.

7. Bronchoscopy should be done, or at least the advisability of bronchoscopic operation should be considered, in all cases of so-called postoperative massive collapse of the lungs.

Fig. 65.—To determine whether lipiodol would completely fill a lobule of lung to give an erroneous interpretation, the lungs of a dog were inflated and lipiodol injected through the bronchoscope. This picture of massing of the lipiodol has been mistaken for an abscess.

Pneumography by Lipiodol; Its Present Uses and Limitations. In their experience D. C. Smyth and L. A. Schall[1] have found that the simplified methods of using lipiodol are not of real diagnostic aid in obscure lung conditions. Thorough cleansing of bronchial tree as a preliminary is essential. Real lung abscesses can usually

(1) Ann. Otol., Rhin. & Laryng., December, 1927.

be shown only by exclusion—that is, by mapping out the normal lung about them with lipiodol, the reason for this being that they are not empty cavities but are usually filled with secretion and only draining out their overflow, this outlet being in many cases far removed from a bronchus explorable with the bronchoscope. It is very easy, by injecting a terminal bronchus with lipiodol, to give the appearance of a lung abscess in the x-ray picture (Fig. 65).

The authors' best results so far have been by placing the lipiodol in the bronchus of the affected lung at a location favoring its flow of gravity toward the pathologic area, this flow being helped along by change of posture of the patient. But it is their opinion that a better technic for the use of oil can still be developed. Bismuth subcarbonate powder is superior to lipiodol in certain lung conditions, notably in stenosis of a bronchus, due to any cause whatever, and in foreign bodies.

The authors have found lipiodol swallowed by mouth useful in the diagnosis of tracheobronchial fistula.

The Relation Between the Bacterial Flora and Tracheobronchial Foreign Bodies. C. J. Bucher[2] took cultures of secretion from the trachea and bronchi of 100 patients who had foreign bodies in the air passages. The study of this material showed that a variety of pathogenic bacteria are present in these cases. Many are capable of producing infection. There is usually more than one kind of bacteria present in the bronchus of a single case. In the great majority of cases the degree of infection seems to depend more on the type of foreign body, the degree of obstruction to drainage, the age of the patient and the sojourn of the foreign body in the bronchus than on the kind of bacteria present.

Syphilis of the Esophagus. The points which A. L. Abel[3] emphasizes are: (1) Syphilis of the esophagus is

(2) J. A. M. A., Sept. 1, 1928.
(3) Lancet, Sept. 1, 1928.

probably not so rare as a study of the literature would lead one to suspect. (2) Syphilis of the esophagus is difficult to diagnose by vision alone, either from simple stricture or from a malignant growth. (3) One or more microscopical examinations must be made before pronouncing a case free from malignancy. (4) The patient or his relatives should not be told that he is about to die of cancer when only a specific stricture is present. Conversely, a patient with cancer of the esophagus should not be given antisyphilitic treatment and energetic bouginage, and told that he will soon be quite normal. (5) Treatment must be by dilatation, as for any simple stricture of the esophagus, and, in addition, very prolonged antisyphilitic treatment must be undertaken.

The author reports two cases, with illustrations of the lesions as seen through the esophagoscope.

A Study of the Lower End of the Esophagus. H. P. Mosher and G. W. McGregor[4] have made a gross and microscopical study of the human esophagus and report that in none of their 14 specimens were they able to find an anatomical sphincter at the cardiac end of the esophagus. They attribute the normal closure of this portion of the esophagus to the presence of deep vertical folds, elastic tissue, and the natural twist of position and to pressure of the left crus behind and the liver in front.

In one autopsy specimen the pathological changes resulting from cardiospasm were found to consist of dilatation and thickening of the walls of the upper portion of the esophagus with a narrowing at its lower end where the walls were of normal thickness. Grossly, this narrowing was increased by a marked backward bend of the portion just above it. An enlargement and an S-shaped curve of the esophagus were present just above this bend. Microscopically, the most important finding was an absence of the ganglion cells of Auerbach's plexus in the narrowed terminal portion. This diminution or practical absence of ganglion cells is one of the most constant

(4) Ann. Otol., Rhino. & Laryng., March, 1928.

and important findings in cases of cardiospasm of long standing and is probably the result of a pressure anemia indicating that the muscles of this portion have ceased to function. Under these circumstances the lower end of the esophagus is closed because of pressure from without, due to the inflation of the tips of the lungs and the crura, the action of the elastic tissue, and the backward bending of the esophagus.

In nine consecutive cases of cardiospasm the diagnostic barium bougie showed a waist-like portion, 19 or 20 mm. in length, at the terminal portion of the esophagus above the level of the crura. This portion took the form of the lung tips and was most pronounced when they were inflated. Mosher used a Sippy rubber dilator painted with stripes of barium and rubber cement and was able to observe the dilatation of the lower end of the esophagus. In all but two cases the narrowing dilated under light pressure (3 or 4 lb.) until the esophagus reached its normal width of 31 mm. This dilatation was followed by a great improvement in symptoms for weeks or months.

Cardiospasm and Concomitant Esophageal Diverticulum. J. H. Fitzgibbon[5] reports the case of a man, aged 61, a painter and paper-hanger. He complained of difficulty in swallowing of four years' duration. This had developed gradually and, in his opinion, was the result of violent attacks of vomiting which occurred with lead poisoning four years previously. He had had four attacks of lead colic, the first eight years before admission to the hospital. Diarrhea had persisted since the last attack, and he was passing from six to eight mushy or watery stools daily. There was no visible blood and very little mucus in the stools.

A chronic cough, particularly at night, had persisted since influenza in 1918. Associated with difficulty in swallowing, there was at times a burning pain in the region of the xiphoid cartilage. This came on while

(5) J. A. M. A., Sept. 1, 1928.

eating and frequently continued for two or three hours. It was not relieved by soda. Food seemed "to stop just before going into the stomach," and was "forced into the stomach" by continued swallowing or tapping over the epigastrium. In recent years he had noticed that it took much longer than usual to eat, and said that it required "twenty minutes to eat a meal which should be eaten in ten minutes." He had learned to be careful of his diet, as he was unable to swallow meat or coarse foods, although liquids, particularly warm liquids, passed with slight difficulty.

Vomiting, which had been violent with the last attack of lead colic, then occurred irregularly and was not forceful. He occasionally vomited or regurgitated while having distress after eating, and found that the distress was relieved by regurgitation. Material regurgitated consisted of food particles mixed with mucus. Belching was common in an effort to relieve a sensation of "gas on the stomach." A gradual loss in weight accompanied dysphagia, there being a total loss of 40 pounds (18 Kg.) in five years.

In addition to conditions mentioned above, the past history included measles, chickenpox, typhoid and malaria. He had formerly used alcohol in excess but denied recent alcoholism. An epithelioma of the lower lip had been removed at the Multnomah Hospital in 1919, the submental and submaxillary lymph nodes being removed at the same time. There was no sign of recurrence.

Physical examination was essentially negative except for emaciation and tenderness over the colon. The blood Wassermann examination and other laboratory tests were negative.

X-ray examination of the chest revealed increased density of the peribronchial and hilum shadows. The esophagus was moderately dilated and was obstructed at the hiatus esophageus. Just above the diaphragm and extending toward the right was a large oval divertieu-

lum which retained barium in all positions, as shown in the accompanying illustration. X-ray diagnosis of cardiospasm with concomitant esophageal diverticulum was made. (Fig. 66).

Fig. 66.—Cardiospasm with large diverticulum of lower end of esophagus.

Esophagoscopy was performed. The entrance to the esophagus and its walls were normal in appearance to the level of 24 cm. from the incisors, where the mouth of a diverticulum was found. This was directed to the right. The opening into the pouch was about the caliber

of a normal esophagus and its walls were of the same color. The esophagoscope was passed into the pouch to a depth of from 5 to 7 cm. A cotton tipped applicator passed into the esophagus below the diverticulum met no resistance at first, but on withdrawal was firmly grasped by a spasmodic contraction of the esophagus.

Obviously, there was little to do for the diverticulum, but, after the patient had swallowed a silk thread guide, the cardia was dilated with a 6-inch Sippy air bag dilator inflated gradually to a pressure of 150 mm. of mercury. There was great improvement in swallowing during subsequent weeks while the patient was under treatment for diarrhea. Not having been seen for many months, the patient was recently sent for, and was found to have died several months before from the effects of "canned heat" taken internally.

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